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THE GODAVARI PALAEOLITHIC INDUSTRY

By

HASMUKH D. SANKALIA
M.A., LL.B. (Bombay), Ph.D. (London).

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The Godavari Palaeolithic Industry

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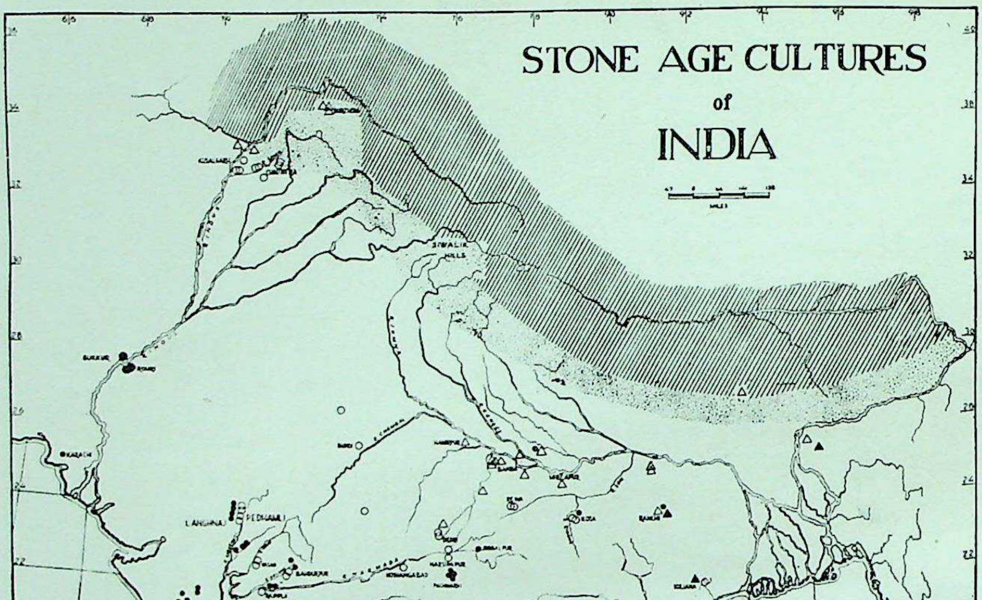
STONE AGE CULTURES
of
INDIA
MILES
SIWALIK HILLS
KARACHI
SUKKUR
ROHRI
LANGHNAJ
PEDHAMLI
GANGAPUR
ARABIAN
SEA
BAY OF BENGAL
INDEX
GLACIATED TRACT
SIWALIK FORMATIONS
○ PALAEOLITHIC SITES
● MICROLITHIC SITES
△ NEOLITHIC SITES
▲ FIND SPOTS OF SHOULDERED CELTS
● PROTO-NEOLITHIC SITES

(Add Ghargaon, and Sangamner s.e. of Gangapur, Ahmadnagar District).

Fig. 2. Map showing the new palaeolithic sites in relation to the known ones.

Introduction

At Gangawadi (Gangapur) the Public Works Department of the Bombay State are building a huge earthen dam, with a view to collecting the head-waters of the Godavari.[1] For this purpose a trench over two miles in length was cut. At that time (January 1951) we were digging on the mound at Nasik proper. One day we had gone to explore the region around Govardhan (a village, adjacent to Gangapur). A local friend, Shri. P. B. AURANGABADKAR took us round to Gangawadi Dam works. When I saw the deep cutting, I was surprised to see a series of layers forming the sides of the trench. Some of these were formed by gravel and contained large blocks of stone and pebbles. This sight was most unusual for this part of India. Here the river beds are not very deep. The banks are scarcely 20 feet to 30 feet high, and the water, for the most part, flows over a rocky bed. Rarely large pebbles are found in the thin sheets of gravel, which at places cover the underlying rock. The trench at Gangawadi at once reminded me of the Sabarmati in Northern Gujarat. In its stratified deposits a rich palæolithic industry was previously discovered.[2] It was, therefore, decided to examine the trench at Gangawadi.

As expected its lower layers yielded a well developed palæolithic industry. Though the material used is different, in type and technique, it is similar to the industries collected by us from the north and south of the Deccan (Maharashtra)[3]. This year (February 1952) tools were also discovered in a new cutting at Gangawadi, as well as in the pebble and gravel bed along the right bank of the Godavari, opposite Jalalpur. Only three days could be devoted to the search of tools in the trenches. For, the bull-dozers were working alongside with us, and rapidly filling up the trenches. These are now sealed up. Where there was once a prehistoric river bed stands now a huge earthen dam.

A chance discovery thus helps us in filling up an important gap in the early prehistory of Western India. It is now possible to say that a developed Hand-axe and Cleaver Industry flourished from Northern Gujarat to Karnatak. In the absence of animal fossils in the beds containing the tools it is not possible to determine its exact age, but it should most probably belong to the Upper Pleistocene period.

My grateful thanks are due to Shri. G. G. DHANAK, Executive Engineer, Gangapur Storage Works, and his assistants, particularly Shri. BHALERAO for affording all facilities while examining the steep and vertical trench walls. Shri. DHANAK was also kind enough in supplying me the necessary plans and drawings for the study of the area. Some of these are reproduced here with

---

1. See Map, Fig. 1, prepared from 46 H/12 × 16 and other sheets of the Survey of India Maps. 1 Inch = 1 Mile. In the map the names of places are spelt as given in the original survey sheets. Here their correct spelling is given.
2. SANKALIA, H. D., *Investigations into the Prehistoric Archæology of Gujarat*, Baroda, 1946.
3. See Index Map, Fig. 2 showing palæolithic and other Stone Age Culture sites in India.

the permission of the Government of Bombay. I am also thankful to my colleagues Dr. Iravati KARVE, Shaikh Zainuddin ANSARI and Shri. R. V. JOSHI for assisting in the collection of tools and surveying the area. A debt of gratitude will always remain to Shri. AURANGABADKAR, whose enthusiasm took us to the Gangawadi Dam Works, and Shri. B. PATANKAR, Principal, H. P. T. College, Nasik, for his hospitality.

The photographs and drawings of tools and sections have been made by Shaikh Zainuddin ANSARI.

A part of the expenses for conducting the explorations and excavations was paid by the University of Poona, under whose auspices the work was done at Gangawadi and Nasik. It also contributed a substantial sum towards the cost of publication of this Report. For both these grants the writer is thankful to the University of Poona.

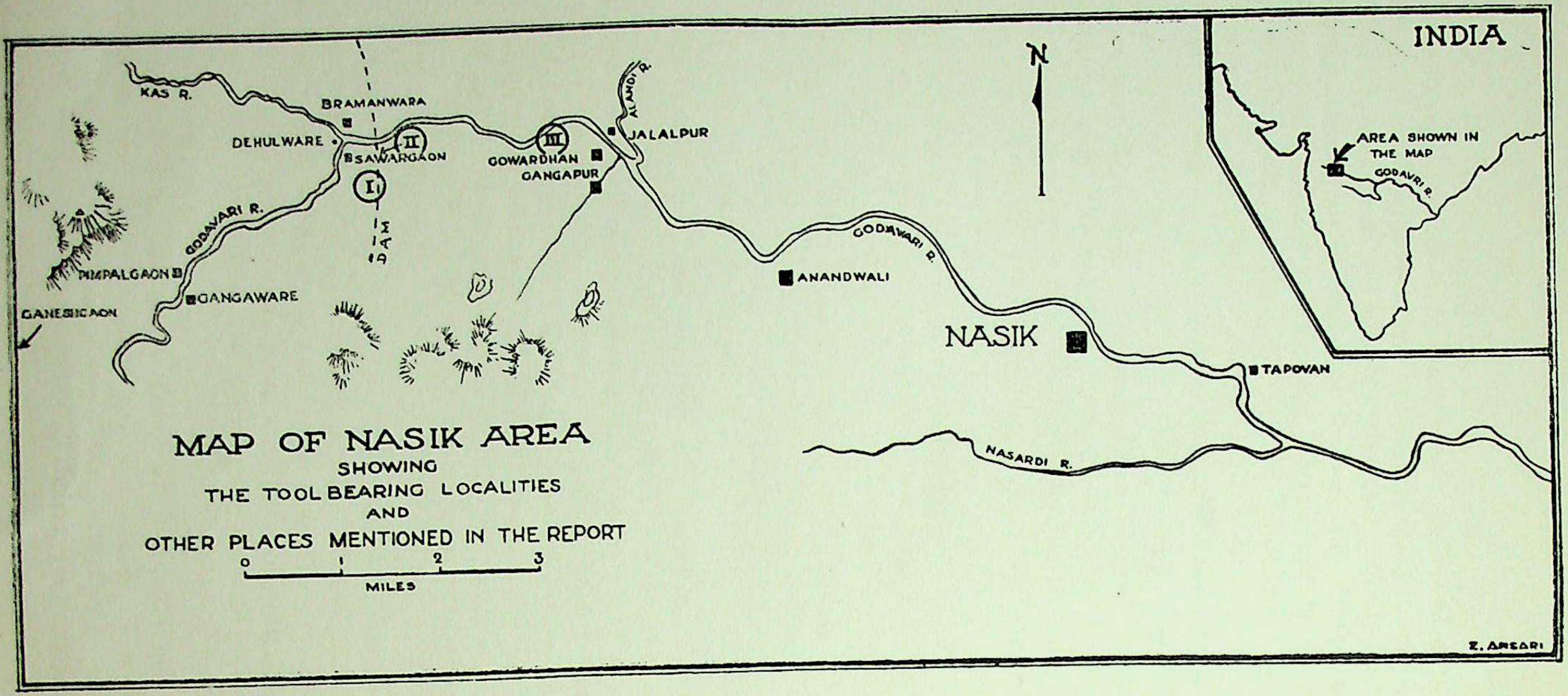
MAP OF NASIK AREA
SHOWING
THE TOOL BEARING LOCALITIES
AND
OTHER PLACES MENTIONED IN THE REPORT
0
1
2
3
MILES
INDIA
AREA SHOWN IN THE MAP
GODAVRI R.
N
KAS R.
BRAMANWARA
DEHULWARE
SAWARGAON
I
II
III
GOWARDHAN
GANGAPUR
ALANDI R.
JALALPUR
GODAVARI R.
PIMPALGAON
GANGAWARE
GANESHGAON
ANANDWALI
NASIK
TAPOVAN
NASARDI R.
Z. ANSARI

Fig. 1

The Site

Gangapur is a village, about 10 miles north-west of Nasik, one of the most ancient cities in Western India. To the west, or south-west of Gangapur is a hamlet, called Gangawadi. All these three places lie on the right bank of the Godavari river. The Godavari rises in the hills of Trimbak, about 18 miles west of this area and debouches into the plains of Gangawadi-Nasik. At present after emerging from the high lands at Ganeshgaon, and skirting the low hills to the south of Gangawadi, it suddenly takes a very northerly course, and after almost completing a large semicircle, reappears southwards at Nasik.[4] It is this bend which seems to be significant in the history of the river.

The proposed dam is situated at a distance of about half a mile from this bend. It spans and engulfs the north-south lying villages of Brahmanwada and Sawargaon respectively. To the west of the first village, at the junction of the Godavari with its tributary the Kas, is the hamlet of Dehulwada.

The tools were found at two localities in the trenches dug for the dam, as well as a little down stream on the right bank of the river. These are called here Localities I, II and III respectively.

Detailed discussion of the stratigraphy of these localities can be better appreciated, if we turn a little to the geology of the area.

Geology of the Area

The geology of the area, or in fact of the Deccan (Maharashtra), is extremely simple. During the late Tertiary or early Eocene times sheets of lava spread over the older rock formations from Malwa in the north to Dharwar in the south. As a result the whole country has been under the mantle of basaltic rock. River, wind and other atmospheric agencies have reduced the resultant flat land mass into hills, plateaus and plains. The hills present a castellated or terraced appearance. Hence the basaltic rock is popularly known as the Deccan trap. Along the coast, and higher altitudes where the rainfall is heavy, the surface of this rock has turned into laterite.

The Western Ghats, as the entire hill formation from north to south is known, gradually slope eastwards. The major drainage system of the whole area therefore follows this earth movement. But along the west coast small, fast flowing rivers, descend the steep escarpment of the ghat and meet the Arabian Sea on the west.

The rainfall in the hills is heavy, varying from 100-200 inches and more within a period of four months. But on the plateau of which the region under consideration forms a part receives not more than 30 inches during the same period.

---

4. See Map, Fig. 1.

The flat hill tops are heavily forested, and the plateaus and plains once had a thick vegetation. Deforestation has reduced this considerably.

The surface soil differs not only from region to region but from place to place in the same region. In some parts of the Deccan it is not more than two feet in thickness, and consists of light brown to sticky black soil, which is not very fertile. In others, *e.g.,* in parts of Ahmadnagar District, which lies immediately to the south-east of the Nasik District, a thick layer of black regur soil makes it the granary of the Deccan, provided it receives adequate moisture. The area around Nasik is moderately fertile. At Gangapur one sees luxuriant mango groves blossoming on a thick sheet of dark brown soil, suddenly replaced by a thin cover of gravelly light brown soil, and then again moderately thick patches of brown soil, on which grow wheat and gram.

The important thing to be stressed in this brief account of the present environment of the land is that the river valleys are generally shallow and their banks consequently low. Not more than two or three strata, consisting of the surface soil of light brown or black soil, sometimes a thin layer of gravel, and then the underlying basaltic rock are the only deposits available for inspection. The gravel stratum contains small pebbles of quartz, agate, chalcedony, etc., but rarely large pebbles of trap. Years of diligent search in these beds had not revealed any unmistakable human artifacts. Earlier geologists, like FOOTE,[5] had therefore concluded that the Deccan plateau being heavily forested was never penetrated by Early Man. It was also conjectured[6] that traces of Early Man, if he had ever existed in these parts, would be there lying on the surface of the land, but out of context.

To this picture of the land, and its sub-recent formation, a view of the trench at Gangawadi offered a suprise and a much-needed corrective.

Tool-Bearing Localities

LOCALITY I : The first locality examined by us was on the Dam Site No. 3, a little south of Sawargaon. The longitudinal profile of the present land surface shows that the area forms a trough. Where the latter deepens, it is cut by the present channel of the Godavari[7]. This trough, as revealed by borings, trial pits and the trench cuttings had an uneven rock surface. One bore (No. 3) touched the rock at a depth of 62½ ft. This thick deposit was comprised of five layers, excluding the lowest, *viz.,* rock[8]. The upper three, from the top downwards, consist of (1) the black soil, (2) black fissured clay, and (3) conglomerate.

---

[5] FOOTE, *The Foote Collection of Indian Prehistoric and Protohistoric Antiquities, Notes on their Ages and Distribution,* (Madras, 1916), p. 41.

[6] *Cf.* ZEUNER, F. E., *Prehistory in India,* (Poona, 1951), p. 13.

[7] See Fig. 3.

[8] Section, Fig. 4.

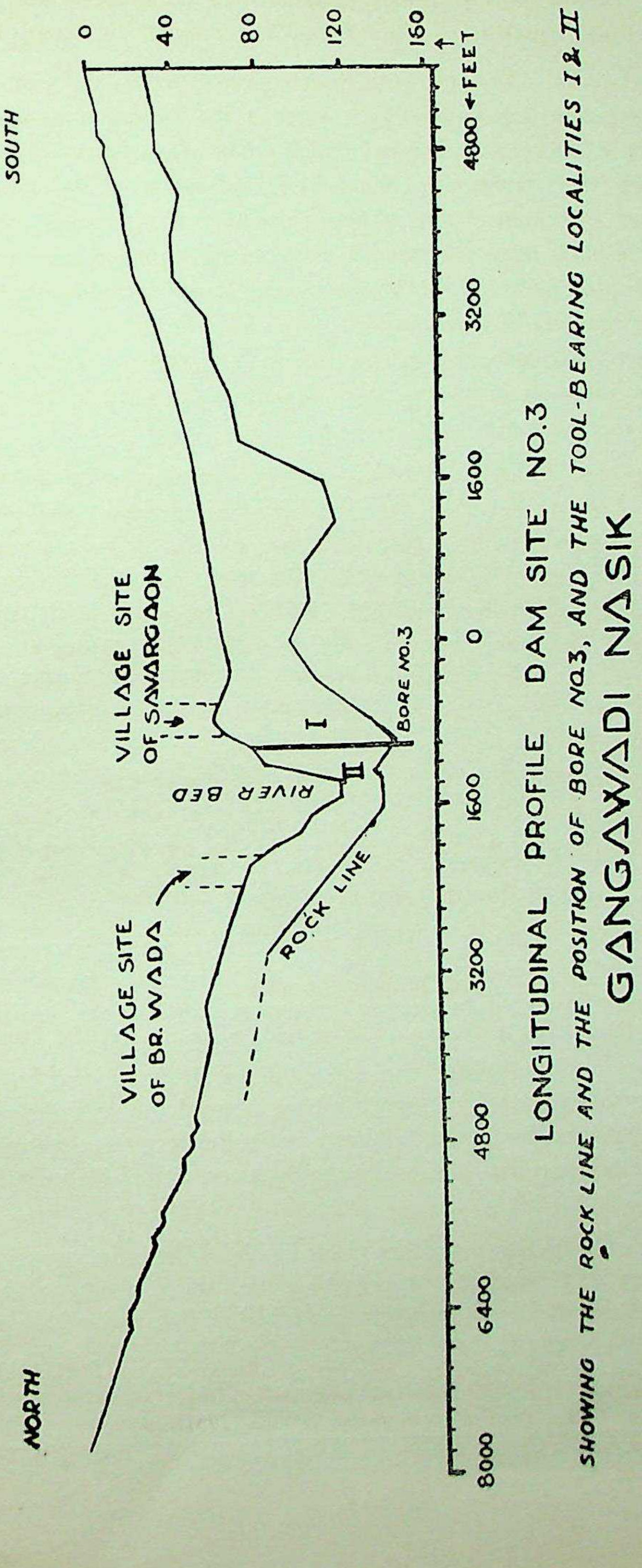
SOUTH
NORTH
0
40
80
120
160
← FEET
4800
3200
1600
0
1600
3200
4800
6400
8000
VILLAGE SITE OF SAVARGAON
VILLAGE SITE OF BR. WADA
RIVER BED
ROCK LINE
BORE NO.3
I
II
LONGITUDINAL PROFILE DAM SITE NO.3
SHOWING THE ROCK LINE AND THE POSITION OF BORE NO.3, AND THE TOOL-BEARING LOCALITIES I & II
GANGAWADI NASIK

Fig. 3

As the rock level is extremely uneven, the stratification differs from bore to bore, and trench to trench. In some, the layers two and three are completely missing or their positions seem to interchange.

This area was dug later. At Locality I the section shown in the accompanying figures[9] was observed by us. The topmost layer of black soil was removed previously. The layers three and four are capable of subdivisions as shown in our drawing of the section. Practically all the tools were found in the lowest pebbly gravel or at its junction with the fissured clay. Very few tools were found in the upper pebbly gravel and only one in the fine gravel.

During the second visit in May 1951, Shri. Joshi and Shaikh Zainuddin did not find any tools. There was no pebbly gravel layer in the section observed by them. About 48 feet of deposits consisted of fine sand with characteristic current or cross bedding, intercalated at places with the upper-lying brown fissured clay. The latter was overlain somewhat unconformably by the black soil.

Locality II : Shaikh and I visited the area again in February 1952 to examine a fresh cutting. The spot examined by us was about 600 feet south of the actual bed of the river. This time the pebbly gravel was again found exposed. At places the gravel, and the associated pebbles were stained by a coal-black substance[10]. Chemical examination revealed that this contained 15% vegetable matter. Though a large number of pebbles, including huge boulders over two feet in length and almost equally broad, were noticed in the lowest layer, we did not find any tools *in situ*. But one beautifully worked core was found lying near the boulder bed. It no doubt belonged to it. And had it been possible to examine this trench earlier, many more tools would have been probably found *in situ*.

Locality III : During this visit a part of the present river bed was also surveyed. Our object was to search for tools as well as to examine the *nalas* (gullies) with a view to locating the ancient gravel spread, southwards from the present channel. This might help us in fixing the course of the prehistoric river. From about two miles east of Brahmanwada to about one mile west of Nasik, that is roughly over a stretch of 10 miles on the right bank, pebbly or fine gravel beds were noticed only at three places ; this also in very small patches. Otherwise the banks on either side were found covered with alluvial silt.

Of these only the first gravel site yielded tools. The actual spot is about one mile west of Govardhan, opposite Jalalpur. Here about 30 feet of brownish earth capped by humus overlies a bed of fine and pebbly gravel bed. Three tools, one U-shapped cleaver, a fine bifacial flake point, and a large flake, worked on the upper side were found well embedded in the lower pebbly gravel bed.

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[9] Figures 5 and 6 (photo).
[10] Figures 7 and 8 (photo).

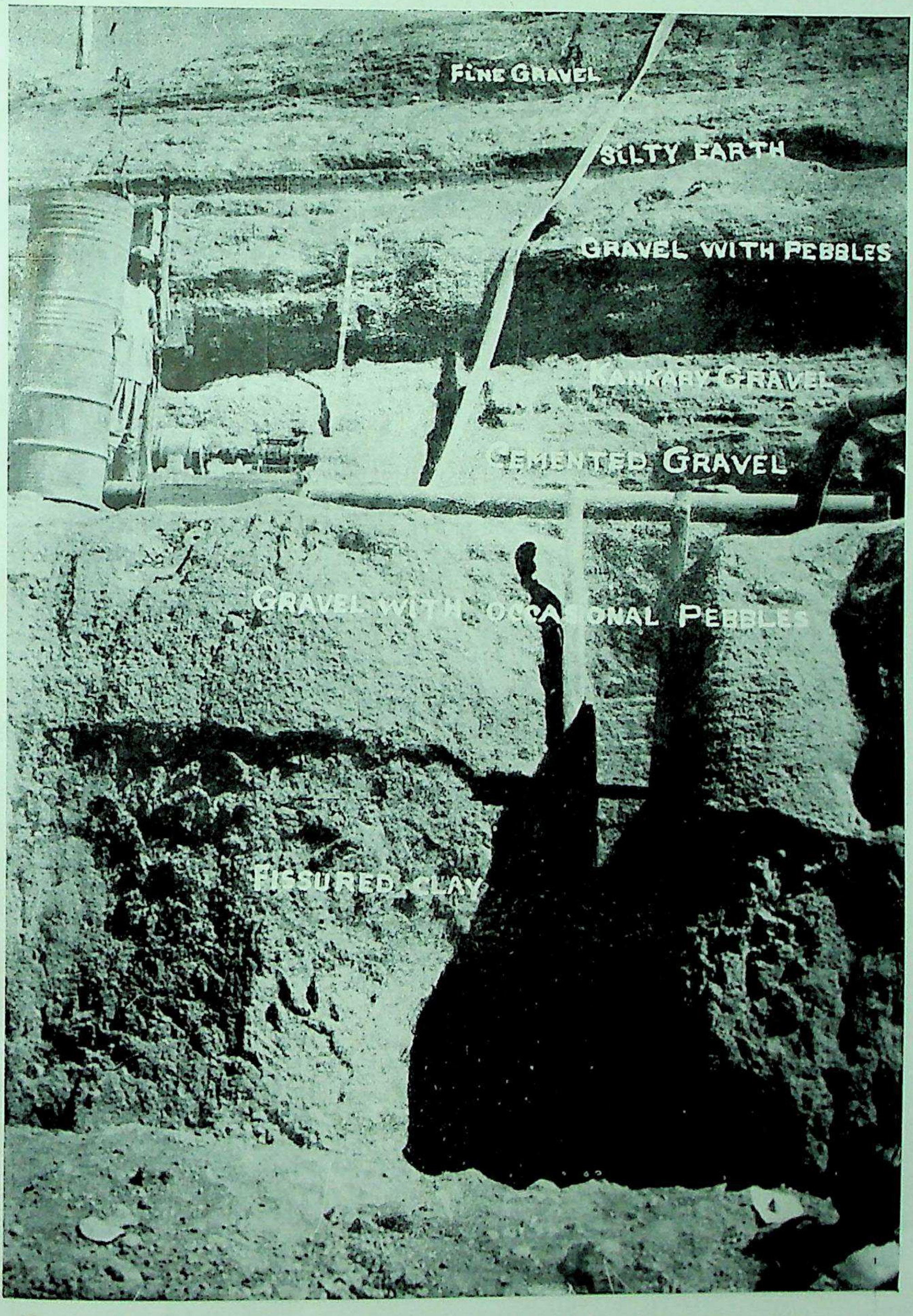

FINE GRAVEL
SILTY EARTH
GRAVEL WITH PEBBLES
KANKARY GRAVEL
CEMENTED GRAVEL
GRAVEL WITH OCCASIONAL PEBBLES
FISSURED CLAY

Fig. 6. SECTION, LOCALITY I, TRENCH, DAM SITE, NO. 3, GANGAWADI.

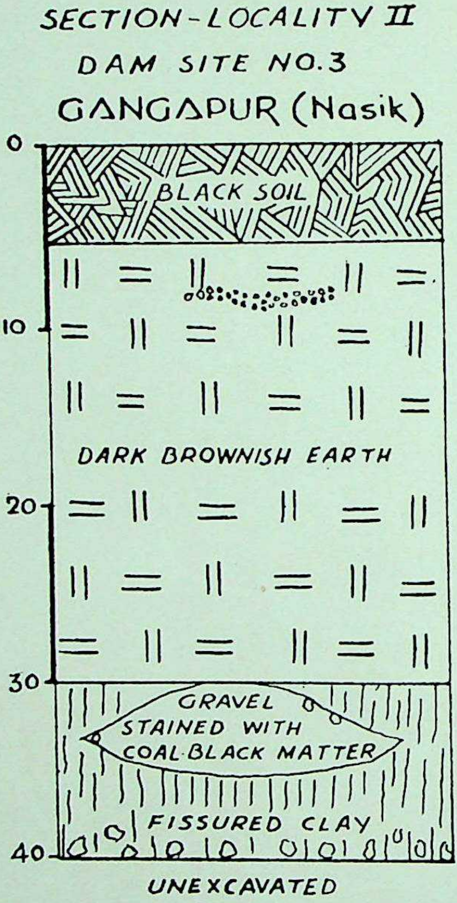

SECTION-LOCALITY II
DAM SITE NO.3
GANGAPUR (Nasik)
0
10
20
30
40
BLACK SOIL
DARK BROWNISH EARTH
GRAVEL STAINED WITH COAL-BLACK MATTER
FISSURED CLAY
UNEXCAVATED

Fig. 7

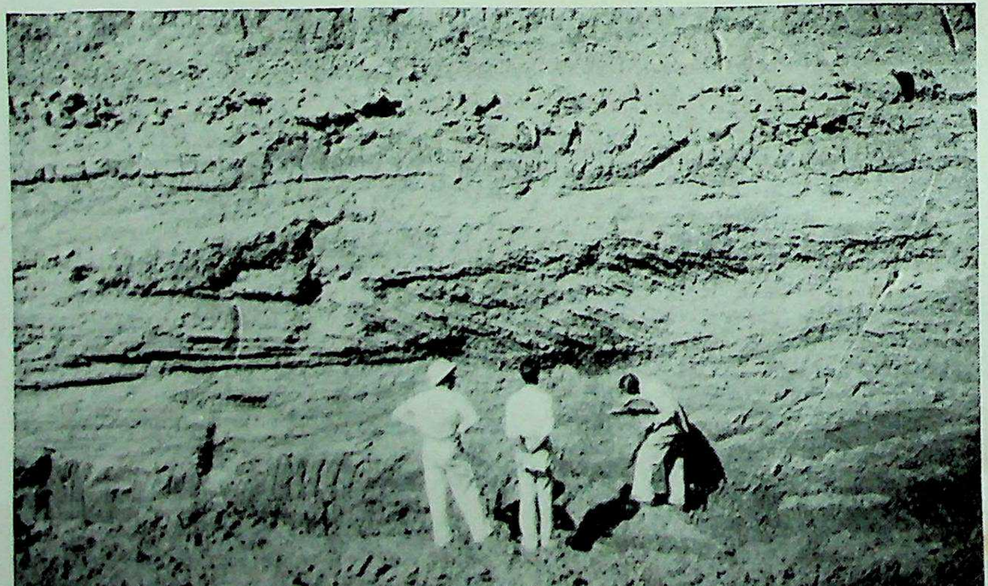


Fig. 8 SECTION, LOCALITY II, GANGAPUR.

Further down, exactly opposite Jalalpur, and a little west of the Godavari's junction with the Alandi river, in a small *nala* (gulley) the pebbly gravel was observed, extending at least 200 feet southwards. It was overlain with terraces of brownish earth and recent humus. Both these sites are shown in a generalized section below[11].

Still lower down, about a mile and a half east of Anandwali, huge weathered greyish gravel blocks lie on the exposed rocky banks.

As mentioned above, it was most unusual to find such fluviatile and other (?) deposits in the Deccan (Maharashtra). The engineers who are accustomed to build on rock foundation were also probably disconcerted at not finding the rock bed so easily and within easy reach at Gangawadi.

The explanation of this phenomenon may be ventured. It should be however regarded as purely tentative, until the problem is studied by a Pleistocene geologist.

It appears that formerly the Godavari, after emerging from hills flowed in a broad, very uneven bed. At places the latter was considerably deep. The course of the river was generally much more southwards than it is at present. But depending on the contour of the land, and the force and volume of water, the river swayed to and fro. During this movement it filled up the various depressions with its load of huge boulders, pebbles, fine gravel and silt. The presence of huge boulders suggests that the climate at the beginning of this period was wetter than at present. At times some spots were left untouched by the river, and so fine clayey silt, was formed in these undisturbed pools of water, or vegetation grew up on slightly elevated areas. It is for this reason that there are extensive signs of cross bedding, gravels intercalated with fissured clay, or vegetable matter staining the gravel and clay, or the complete absence of fissured clay or the gravels or their transposition.

Early Man lived on the foothills and along the banks of this widely swaying river. He made tools out of trap boulders and the rock around him, and very rarely from pebbles. For the last not being water rolled, as in rivers with sandy beds, but probably the result of spheroidal weathering, foliation etc., were not strong enough for making tools[12]. In fact, in the collection there are not more than a couple of tools made out of pebbles, and real pebble tools are not there at all. Depending upon the site of man's habitation in this wide area, full of small ponds of water, these tools are now found embedded sometimes in gravel, sometimes in fissured clay or at their junction. But it is remarkable that the average depth of these tool-bearing layers is between 30 to 35 feet below the present land surface.

When gradually the trough was filled up owing to aggradation, and probably due to other reasons as well—climatic and geologic—the river changed its bed and dug out a new channel farther away. This seems to be generally due north of the original bed.

---

[11] Fig. 9.

[12] I am indebted to Shri. R. V. Joshi for this suggestion.

Traces of such shifting of river beds and an earlier southerly flow of the Godavari were also available at Nasik, and elsewhere in the region.

At Nasik proper the mound of the early historic period, as well as the Matha of Ghatghe Maharaj stand on an ancient river terrace[13]. Now the river flows at its foot. But from here on we can trace a chain of river terraces lying to the south at a distance of a furlong or two and going eastwards as far as Tapovan. Here the river has cut out a deep gorge. This might have been formed when the river, perhaps violently, changed its bed. A long period of aggradation seems to have been followed by a period of valley cutting. This itself might have been due to changes in climate.

Such scenes of river shifting can also be seen at Kopargam, Javale-Kadlag on the Adhala, and at Gunodi[14], on the Sodhala in the Ahmadnagar District, and at Bahal in the East Khandesh District.

But nowhere in these old river beds, either at Nasik proper, or at other sites on the middle reaches of the rivers does one notice large pebbles. Generally these beds are composed of fine yellowish alluvium and coarse gravel and sand. The pebbles, if at all, are small and black in colour. Two exceptions to this feature should be noted. At Gangawadi after examining the trench we visited a nearby *nala*. It was also found to be silted up by aggradation deposits. But here and there in it were pebbles, and a well formed tool was found among these.

Another *nala* which was found to be full of large pebbles and blocks of stone was noticed on our way to the examination of Gunodi Dam works mentioned above. It is near the village of Gunodi.

Contrary to the general belief that rivers in Maharashtra have not changed their courses owing to their being entrenched in a rocky terrain here is evidence to prove that such changes have taken place in the past.[15] And more evidence of the existence of Early Man and his environment will probably be found in such ancient deposits whenever they come to light and are examined.[16]

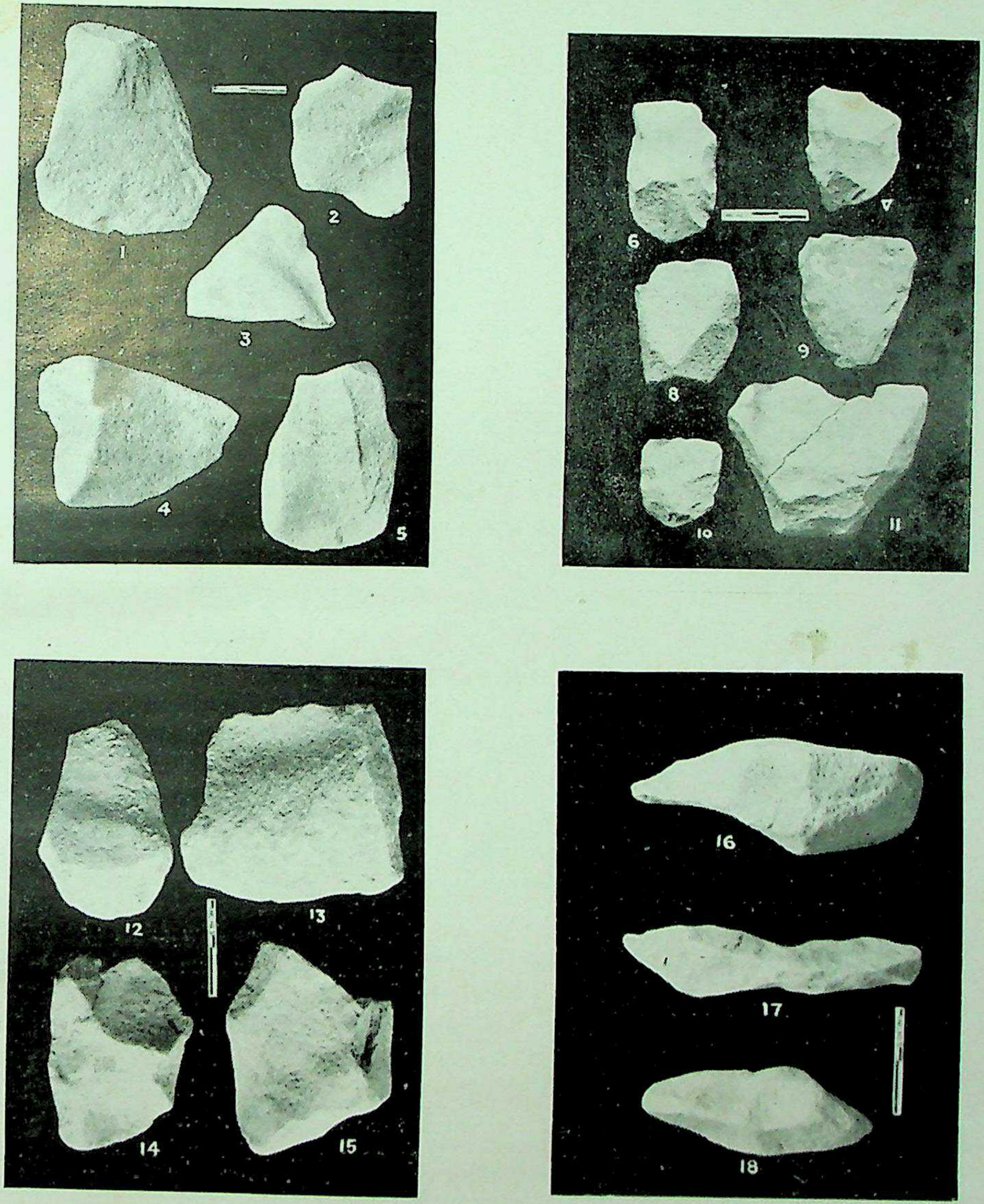
---

[13] Fig. 10.

[14] Fig. 11.

[15] Professor ZEUNER had anticipated such a phenomenon, though during the course of our short visit, we could not collect much evidence. He wrote (*Stone Age and Pleistocene Chronology in Gujarat*, p. 37), "The rivers near Nasik flow on a matured land surface......however, the profiles of the rivers are not graded and they present many knick-points which indicate shifting of the river bed in Pleistocene times."

[16] Working on these clues, Shri M. N. DESHPANDE, Superintendent, Archæological Department, Western Circle and his assistant Shri SALI have recently found palæoliths at Sangamner on the Pravara and at Ghargaon on the Mula, both in the Ahmadnagar District.


1
2
3
4
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8
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10
11
12
13
14
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16
17
18

Fig. 48

Flakes : 1 (11), 2 (62), 3 (17), 4 (37), 5 (55). Cleavers : 6 (13), 7 (1), 8 (38), 9 (53), 10 (28), 11 (15). Side Scrapers : 12 (40), 13 (61), 14 (43), 15 (2). Hand-axes : 16 (10), 17 (64), 18 (42).

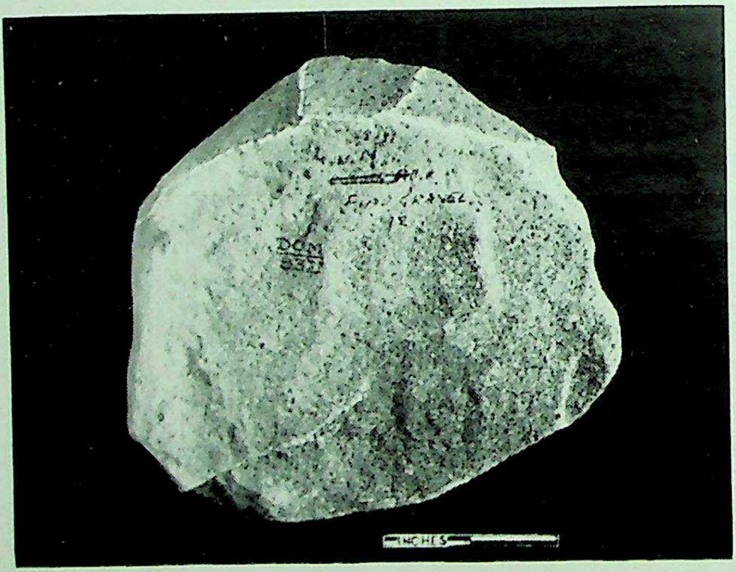

Fig. 49. Levallois-like flake from Fine Gravel, Locality I, Gangapur.

Another inference which seems to follow from this study is that many of the present river valleys in Maharashtra or to be more precise in the districts of Nasik and Ahmadnagar are young. Whether the older rivers were silted up owing to simple climatic reasons, and consequent aggradation etc., or tectonic causes also contributed to the modern topography need to be studied from the point of view of quaternary geology.

We may now turn to a consideration of the character of the palæolithic industry.

The Godavari Palæolithic Industry

A few general observations may be made before proceeding to the detailed description of tools from the three localities. Excepting one tool, as mentioned previously, a large majority of the tools was excavated from the lowest gravel or its junction with the fissured clay. The one exception belongs to the layer of fine gravel in Locality I. Thus, out of 65 tools here described 64 are from the lowest layers. A large number of these consists of flakes, or tools made on flakes, and only a few cores, or tools made on cores. Their proportion is as follows :

Cores	10
Hand-axes on core	2
Flakes	52

However, the technique employed in working on the flakes is essentially bifacial. The flakescars are generally large and deep. Though ' step ' flaking is evident, there is no trace of the use of wooden or bone hammer. The finished tools, according to the conventional terminology, are either scrapers, cleavers, hand-axes, points or choppers. Of these, the first—scrapers—seem to be definitely a new type, and may be regarded as a special feature of the industry while, as in the Malaprabha Industry, cleavers preponderate. There are no pebble tools. The Godavari Palæolithic Industry may, therefore, be assigned to the Abbevillian Hand-axe-Cleaver complex, among the Stone Age Cultures of India. And, if more tools of the Levallois-type are found, in future, from the upper layers, then the development of the bifacial into Levalloisian or the arrival of a new element can be positively asserted. For the present, we may merely note the presence of a Levalloisian trait in the industry.

The Condition and Types of Tools

Locality I

CONDITION : In all about 60 tools were found from this locality. All are made of basaltic trap, and except one, have an olive green colour. The flake scars are slightly, but in a few cases considerably, effaced. Some tools have tiny holes on their surface, as if they were pecked by a pin. Some tools have become brittle, hence they break easily while extracting, or if not properly handled.

TYPES OF TOOLS

I The Flakes

These fall into the following types :—

(A) *Clactonian-type flakes,* with prominent bulbs, or with signs of intentional removal of the bulbs ; simple platform, and the angle over 120°. (Nos. 11, 33, 38, 41). Of these the following are illustrated and described in detail.

No. 11—Large flake, probably out of a block of basalt, very prominent bulb and the angle is of 135°. There is a longitudinal flake scar on the upper surface, which probably removed the ridge. There are two others on the butt-end side. Rolled and weathered, with a recent break on one side. (130 mm. long, 177 mm. broad, 45 mm. thick). Fig. 12.

No. 41—Small flake with more or less a central ridge on the upper face. Four flakes are removed from one side of the ridge, but the scars are now very much effaced by rolling and weathering. Prominent bulb and wide angle of 120°. (100 mm. long, 65 mm. broad and 30 mm. thick). Fig. 13, bottom.

No. 33—Small rectangular flake, probably from a block of basalt. Its high, almost mid-ridge, has a deep 'step' flake scar on the butt-end side, and a thin sloping front with a sharp edge on one of the longer axis. The bulb on the underside seems to have been purposely chipped away. The angle is of 120°. (87 mm. long, 61 mm. broad, 37 mm. thick). Fig. 13, top.

(B) *Clactonian-type flakes,* with the under surface flat or even concave and no signs of bulb ; the platform simple or none and the angle of about 120°, or more. (Nos. 7, 8, 13, 16, 18, 19, 21, 22, 23,24, 25, 36, 39, 45, 46, 47, 52, 53, 55). Of these the following are illustrated and described in detail.

No. 8—Rectangular flake, with a high ridge, and sloping sides as in No. 33. It is slightly trimmed along one of the longer axis, but the flake scars are now greatly effaced. The underside is flat, and has no traces of the bulbar scar. (81 mm. long, 73 mm. broad, and 42 mm. thick). Fig. 17, bottom.

No. 18—Circular flake with a flat under surface and a wide angle of 125°. (86 mm. long, 69 mm. broad, and 36 mm. thick). Fig. 14, bottom.

No. 16—Ovoid flake, with a flat under surface and a wide angle of 125°. (93 mm. long, 74 mm. broad, 32 mm. thick). Fig. 14, bottom.

No. 24—Biconvex flake with a bulbar point and a wide angle of 107°. (77 mm. long, 74 mm. broad, and 2 mm. thick).

No. 23—Ovoid flake, with a well trimmed upper surface. Most of the flake scars seem to be due to 'step' flaking. These and others meet in a central humped surface. The underside is flat with a wide angle of 118°. Rolled and weathered. (81 mm. long, 61 mm. broad, 25 mm. thick). Fig. 14, top.

No. 34—Rectangular flake with a high central ridge. A deep flake scar on the right side has given a sharp edge. the under surface is the result of a plunging flake. The surfaces are stained blackish and the flake scars are slightly obliterated. (81 mm. long, 74 mm. broad, and 33 mm. thick). Fig. 15, bottom.

No. 5—Large flake, having the under surface similar to that of No. 34. (112 mm. long, 95 mm. broad, and 32 mm. thick). Fig. 16.

No. 27—Large flake, having the under surface similar to that of No. 34, but very uneven. (119 mm. long, 97 mm. broad, 45 mm. thick). Fig. 17, top.

No. 37—Very large triangular flake (with its tip of the point broken anciently). It has also the under surface similar to that of No. 34, but the angle is very wide. The upper surface is considerably rolled, with numerous holes as if 'pecked'. (127 mm. long, 114 mm. broad, 51 mm. thick). Fig. 18.

No. 55—Very large rectangular flake, with the upper surface steeply rising towards the butt-end. These steep sides bear flake scars which are blurred owing to rolling and weathering. The under surface bears a large deep flake scar, almost running along the entire length of the flake. This meeting with the upper sloping surface forms a broad convex cutting edge. The method of treating the underside reminds one of the Victoria West technique. And the tool may then be taken as a variety of the cleaver. (130 mm. long, 88 mm. broad, 70 mm. thick). Fig. 19.

(C) *Blade-like flakes:* These are only two and are described here for whatever they are worth.

No. 22—Thin, rectangular flake, low mid-ridge on one face, the other face is heavily encrusted with a solution of calcium carbonate, sharp, concave edge, uneven, perhaps due to use. Rolled and with numerous holes, as if pecked. (80 mm. long, 47 mm. broad, 20 mm. thick). Fig. 20, bottom.

No. 8a—Thin, sub-rectangular flake, with a dull point. The upper surface bears three flakescars, the ridges of which are slightly effaced. The underside is probably natural. (90 mm. long, 31 mm. broad, 16 mm. thick). Fig. 20, top.

II Cleavers

In these two main types may be distinguised :

A. Cleavers on End-flakes.

B. Cleavers on Side-flakes.

A. The End-flakes have the following sub-types :—

(a) *Cleavers with thick butt, straight or slightly convex edge, and the upper surface having a mid-ridge or projection towards the butt, steeply sloping sides, and the under surface plain or deeply concave.*

No. 9—Cleaver of coarse basalt, pebble, thick butt with pebble upper surface extending towards one side, and the apex as well. Convex edge formed by the intersection of the upper and under surfaces. (105 mm. long, 75 mm. broad, and 55 mm. thick). Fig. 21.

No. 28—Small U-shaped cleaver, with very symmetrical sides and broad straight, but perhaps used, cutting edge ; with rounded butt and plano-convex surfaces it looks a beauty. The upper surface towards the thick butt-end, as well as the under surface, has been carefully trimmed—that on the under by ' step ' flaking. The flake scars on the underside appear more fresh than those on the upper which are considerably effaced. (80 mm. long, 73 mm. broad, 36 mm. thick). Fig. 22.

No. 36—Cleaver, rectangular, thick unflaked butt, projecting in the centre with a horizontal mid-ridge, roughly trimmed sides, that on the left by ' step ' flaking. Small convex edge (probably used) formed by the intersection of the primary flaked under surface with the steeply sloping flaked upper surface. Slightly rolled. (135 mm. long, 84 mm. broad, 52 mm. thick). Fig. 23.

No. 55—(The flake described above may be included under cleavers of this type).

(b) *Cleaver with sloping butt, long vertical sides, as well as parts of under surface trimmed, and straight or oblique edge.*

No. 1—Cleaver, roughly heart-shaped, probably made out of a basalt block. One of the longer sides, including the butt, bears a series of small ' step ' flake scars. The same is also the case with the shorter underside. A deep scar is also on the other side, near the butt-end. The flake on which the cleaver is made, was very sharply detached from the core. The edge is slightly oblique, in two curves, one a little convex, the other a little concave. (119 mm. long, 82 mm. broad, 59 mm. thick). Fig. 24.

No. 13—Broad, U-shaped cleaver with sloping butt and rectangular body. The longer sides on both faces have been trimmed along their edges by 'step' flaking. A deep, large, flake scar also exists on the top half of the under surface, which was detached in identical manner, as in No. 1. The upper surface has a short transverse ridge and a scar on the butt-end slope. The edge side slope has a slight hollow and then it drops steeply at the edge. This is straight and fairly sharp. Slightly rolled. (127 mm. long, 80 mm. broad, 45 mm. thick). Fig. 25.

(c) *Cleaver with narrow butt, and flaring concave edge.*

No. 15—Large cleaver on thick end-flake, probably out of basalt block. One of the longer sides is trimmed so that it presents a sloping facet. The butt-end also bears signs of shallow flake scars. Probably a large shallow flake was also removed near the broad edge. The under surface, except for a deep flake scar at the butt-end, is otherwise untrimmed. A large concavity, almost in the centre, and a small one near one of the sides characterize the edge. Rolled. Broken in two while extracting. (138 mm. long, 180 mm. broad, 47 mm. thick). Fig. 26 and 26a.

(d) *Cleaver with thick V-shaped butt, and straight edge.*

No. 53—Triangular cleaver made from hæmatite basaltic block, with a thick V-shaped butt. Though the upper surface bears marks of steep flake scars, it is uniformly high, and slopes almost perpendicularly to form a straight edge by intersection with the flat under surface. This is slightly trimmed along both sides by 'step' flaking. Unlike other specimens this specimen has retained its crimson grey colour, and is very little rolled, though it has encrustations of calcium carbonate on the upper surface. (120 mm. long, 103 mm. broad, 45 mm. thick). Fig. 27.

B. Cleavers on Side-flakes :—

No. 38—Cleaver on asymmetrical U-shaped side-flake. There is very little subsequent trimming on the primary flaked surfaces. The bulb is very prominent. The edge is almost straight but broken off at one end. The flake ridges are not sharp, and the tool has considerably weathered showing numerous peckings. (113 mm. long, 96 mm. broad, 38 mm. thick). Fig. 28.

No. 51—Small cleaver, on asymmetrical rectangular side-flake, with the bulb removed. As in No. 38 there is very little subsequent trimming. The under surface is very uneven, and slopes down suddenly to form an oblique edge. (89 mm. long, 75 mm. broad, 30 mm. thick). Not illustrated.

III Side Scrapers

These are thick, roughly semi-circular flakes with worked back and sides and straight edges formed by the intersection of the steeply sloping sides. Their chief characteristic is that all have edges along their longer axis. Among other palæolithic industries of India, or those of Europe and Africa, some tools have been occasionally described as scrapers or described as possessing a scraping edge, but such distinctly made shapes with the edge, sides and the back, seem to be hitherto unknown. So these 'side scrapers' or 'choppers' may be regarded at present a special feature of the Godavari Industry.[1] In all there are six. These are described below in detail.

No. 2—Side scraper, on a thick side-flake, made out of a basalt block. Of its three sides, only one (the right) shows signs of extensive flaking. The proper back has only one flake scar, and the left none at all. The face has no scars either, except the two along the steeply sloping edge side. These were made while preparing the edge, which is not quite straight, and formed by the intersection with the primary flaked under surface. On the right end, the edge is slightly truncated. The tool is considerably rolled. (120 mm. long, 90 mm. broad, 40 mm. thick). Fig. 29.

No. 44—Side scraper similar to No. 2, but on a very irregular flake, probably made out of a basalt block. It has its right side as well as the proper back trimmed but very crudely. The upper face has a deep flake scar at its apex. On the longer axis the edge does not run its full length, as a lump has been left untrimmed, and there is a short edge on the left-hand side. (131 mm. long, 90 mm. broad, 51 mm. thick). Fig. 30.

No. 61—Side scraper on a thick rectangular flake having convex surfaces, so that, in this case, with a minimum of trimming on the proper back and the left side a fine thin long edge has been obtained. This shows a number of concavities, perhaps due to use. The specimen is rolled. (110 mm. long, 113 mm. broad, 43 mm. thick). Fig. 31.

No. 43—Side scraper on a thick, roughly rectangular side-flake, probably out of a basalt block. The left side and the proper back which is rounded are slightly trimmed, while the face has deep flake scars, which form transverse and longitudinal ridges. There are two edges—a short one along the left side, and a long one, along the longer axis, formed by the intersection with the primary flake under surface. The tool is very much rolled, blunting the flake ridges. (133 mm. long, 76 mm. broad, 44 mm. thick). Fig. 32.

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[1] These also characterize the Narmada Industry.

No. 40.—Side scraper-cum-hand-axe, on a thick semi-circular end (?) flake. The thick proper back is facetted, the short left side is broken off recently, whereas the right one is trimmed on both faces into a broad, round, hand-axe edge. The latter also forms a part of the scraper edge on the longer axis, formed by the sloping surfaces on both sides. The tool looks quite symmetrical. It is rolled and the left hand corner is heavily encrusted with calcium carbonate. (115 mm. long, 70 mm. broad, 30 mm. thick). Fig. 33.

No. 31—Side scraper or chopper, on a thick massive flake, ovoid in outline. Three large flakes have been removed from the proper back, and the right and left sides, and one from under the thick butt, while the edge is formed by the steeply sloping fourth side by intersection with the under surface having the primary flake scar. One of the facets on the left side forms a dull point with the fourth side, so that the tool may also be regarded as a hand-axe. It is rolled and weathered having numerous peckings. (145 mm. long, 125 mm. broad, 70 mm. thick). Fig. 34.

No. 39—Side scraper or chopper on a large crescentic end-flake. The straight chord of the back is the part, snapped off from a larger tool, and only the front now remains. This has two thin pointed ends and a wide convex edge formed by the intersection with the primary flake scar of the under surface. The upper surface was very thinly chipped. The tool is rolled and may be regarded as a double-pointed hand-axe. (159 mm. long, 70 mm. broad, 44 mm. thick). Fig. 35.

IV Hand-axes

Only one true hand-axe was found.

No. 42—Small, elongated oval hand-axe, having an irregular, low keel on the under surface, and a central high keel on the upper surface. The latter, however, stops three-fourths of the length. The edges are remarkably straight,—that on the left, almost quite straight,—and run almost around the tool, excepting at the butt which is flat and blunted. The section is diamond-shaped in the centre, but biconvex at the point opposite the butt. The tool is considerably rolled, but it seems certain that no wood technique was used in its flaking. (114 mm. long, 65 mm. broad, 44 mm. thick). Fig. 36.

No. 17—Triangular flake, with a thick back (base), probably snapped off from the body of a larger tool. Its sides converge into a thin sharp rounded point. The under side is the primary flake surface, while the upper is thinned by careful trimming. The top of the right hand side is recently broken. The tool is rolled, and seems to be the front part of a hand-axe. (83 mm. long, 112 mm. broad, 37 mm. thick). Fig. 37.

No. 48—Crude, pointed, hand-axe, probably on a pebble. It has a zigzag edge around, a blunt short point with a thick flat body. It is heavily rolled, and has numerous peckings. (113 mm. long, 77 mm. broad, and 40 mm. thick). Not illustrated.

No. 32—Thick triangular point on a flake. The under surface is the primary flaked surface, while the upper is finely trimmed into a narrow point. The tool is very much rolled, and represents probably the front of a hand-axe, like No. 39. (60 mm. long, 56 mm. broad, 40 mm. thick). Fig. 38.

No. 56—Crude, massive, pear-shaped hand-axe on a block of basalt. The butt-end consists of the original, much weathered basalt matrix. The rest of the surfaces on both sides are crudely flaked so as to give a thick broad point, and irregular edge, almost around, excepting the untrimmed butt. Rolled, and weathered by chemical action, so that it is breaking into pieces. (177 mm. long, 113 mm. broad, 90 mm. thick). Fig. 39.

No. 3—Probably part of an elongated hand-axe on a long, thin flake. This is one of the rare cases where it is possible to say whether a tool is made out of a pebble or not. The underside is simply the flake scar of a plunging flake with its bulbar end broken. There is an attempt to flake the upper surface, and get an edge around. The piece is rolled and weathered and at present broken in two. (135 mm. long, 110 mm. broad, 3 mm. thick). Fig. 38.

V Core Choppers

These are tools fashioned out of cores, left after treating a block of basalt. It is possible to distinguish two types :

(a) Choppers with flat trimmed bases and massive body.

(b) Choppers with biconical surfaces.

Two specimens of each are described.

No. 10—Massive chopper. A large deep flake scar on the under surface has given it a flat base ; the high upper surface is almost equally divided by a mid-ridge. It has thus three faces, all of which are trimmed by bold flaking. The specimen is rolled. (172 mm. long, 150 mm. broad, 75 mm. thick). Fig. 40.

No. 59—Massive chopper. Here too the underside has a large flat flake scar, and the rest of the area is carefully trimmed, so as to give an edge around. The left hand side is probably the side snapped off from the main body. The top has a flat unflaked patch, down which run large, steep flake scars to form the edge, and a dull but effective hammer point, by intersection with the trimmed flat under surface. From the way this point has been achieved, it is clear that the tool was also meant to be used as a hand-axe or hammer. This is one of the best flaked tools in the collection.

Though the flake ridges are slightly effaced, they are clearly recognizable. (157 mm. long, 98 mm. broad, 53 mm. thick). Fig. 41.

No. 60—Biconical discoid chopper. Excepting the flat unflaked butt-end and a small patch on the apex of the upper side, the tool is marked by large and deep flake scars on both faces which intersect and give it a zigzag edge, almost around. The tool is heavily rolled and has suffered from chemical weathering. (133 mm. long, 109 mm. broad, 86 mm. thick). Fig. 42.

No. 58—Core chopper. It is almost similar to No. 60, but flatter on one face, and so much rolled that except for two large flake scars on the upper face, the rest are undistinguishable from the pebble surfaces. (134 mm. long, 126 mm. broad, 70 mm. thick). Not illustrated.

VI Levallois-like Flake from Fine Gravel

Only one specimen was found. This was primarily because it was not easy to reach this layer against the steep—vertical—cliff of the trench. But the specimen is one of the most interesting in the entire collection. It introduces us to the true Levalloisian technique in flakes.

No. 12—A large roundish flake, with fine facetted platform ; its clean primary flake scar forming an angle of 108° with the platform. The upper side has three or four large, thin, flake scars, evidently due to flaking before the flake was detached from the core. There is no secondary trimming. Rolled and weathered, showing numerous peckings. (124 mm. long, 140 mm. broad, 44 mm. thick). Fig. 43.

Locality II

From this locality only one specimen was found. It is however an excellent example of the true core in this industry.

No. 61—Core, roughly rectangular. It is only slightly rolled so that the flake scars are very clear. Among these the one on the upper surface, ending in a slight projection, just above the butt is remarkable. A thin, blade-like flake must have been removed from here. Otherwise, except the butt-end, all the sides are marked by small flake scars. (86 mm. long, 80 mm. broad, 61 mm. thick). Fig. 44.

Locality III

This locality, as described above, lies on the river bank. Three tools were found *in situ* in the gravel bed. These consist of (1) cleaver, (2) side scraper, and (3) point. These are briefly described below :

No. 63—Broad U-shaped cleaver. It is comparable with No. 13 above in shape and technique. However, it is heavily rolled, and weathered. (162 mm. long, 73 mm. broad, 36 mm. thick). Fig. 45.

No. 62—Side scraper, almost rectangular, with a concave under surface. It is thick on two sides, the other two have been flaked on the upper surface, to give a very zigzag edge. With its concave under surface and steeply sloping sides, the tool is comparable to No. 2. Rolled and weathered. (8 mm. long, 88 mm. broad, 30 mm. thick). Fig. 46.

No. 64—Triangular flake, with the underside constituting probably the primary flake surface. The upper shows traces of three or four scars near the point. For the rest, it is difficult to say whether the surfaces were flaked or not. For the specimen is heavily rolled. This is a new type not met with before in Locality I. (134 mm. long, 77 mm. broad, 33 mm. thick). Fig. 47.

The Age of the Industry

No fossil remains were found in the tool-bearing layers at Gangawadi or in the sections along the river bank. However, fossils have been found at Nandur-Madhmeshwar and Paithan.[17] These are believed to be of the Lower or Middle Pleistocene period.[18] But it is not certain whether these fossil beds would be indentical with those from which the tools were collected at Gangawadi and therefore we cannot assume that these beds belong to this period

Recourse must, therefore, be had to the nature or typology of the tools. In these, as mentioned above, cleavers and flakes with prominent bulbs predominate. The presence of cleavers need not necessarily suggest that the industry is Acheulian, as the general presumption is.[19] For the cleavers wherever the traces remain seem to be on Clacton-like flakes. This is also the feature of the large number of simple flakes.

Such cleavers, though rare, also occur on the Vaal river in South Africa and are assigned to Stellenbosch I (Chelles-Acheul I).[20]

At Olduvai in E. Africa which gives an excellent evolutionary sequence of Chelles-Achuel culture, cleavers are, however, first found in Bed III in association with hand-axes of Chelles-Achuel Stage 6, which is regarded as a transitional stage from Chellean to Acheulean technique.[21] The specimen illustrated is described as clumsy and badly made having a biconvex section and not of the parallelogram form.

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[17] See *Mgsi.*, VI, p. 232 and *Rgsi.*, XXX II, pp. 199-202.

[18] De Terra and Paterson, *Studies on the Ice Age in India and Associated Human Cultures*, p. 319. See also Sankalia, "Studies in Prehistory of the Deccan." *Bulletin of the Deccan College Research Institute*, IV (1943), pp. 188-190, where earlier views and theories and fossil remains from tributaries of the Godavari are cited.

[19] Krishnaswamy, V. D., *Ancient India*, No. 3, p. 47.

[20] Lowe, C. Van Riet, *The Geology and Archæology of the Vaal River Basin*, (Geological Survey, Memoir No. 35, 1937), p. 77.

[21] Leaky, L. S. B., *Olduvai Gorge* (Cambridge, 1951), p. 97.

In Uganda cleavers, though not very common, appear for the first time in the 'M' horizon terrace.[22] In section, they are trapezoid, biconvex or parallelogrammatic.

So from a purely typological point of view, the Godavari cleavers are comparable to the early Olduvai cleavers of the transitional stage. Even the finest, symmetrical, small cleaver is biconvex in section and the parallelogram form is not visible in any of the varieties. The latter, however, suggest an advanced stage. Such a variety, almost all the well-known cleaver shapes, is not met with either in Africa, or in Gujarat-Karnatak-Madras Abbevillian.

When this paper was passing through the Press, I had an opportunity to study the sections and collect tools around Maheshwar on the Narmada. I was surprized to find that these—90 per cent of them :—flakes, cleavers, choppers and side scrapers—were on Clacton-like flakes with prominent bulbs. The cleavers include all the types met with in the Godavari Industry, though none has a parallelogrammatic section or any sign of Acheulian technique. One hand-axe, however, does exhibit the latter feature and De TERRA also mentions the discovery of Acheulian tools near Hoshangabad.

Thus a comparative study of the cleavers also indicates an advanced or Late Abbevillian-Acheulian age for the Godavari Industry. And on its typological similarity to that of the Narmada it may be placed in the Middle or the Upper Pleistocene.

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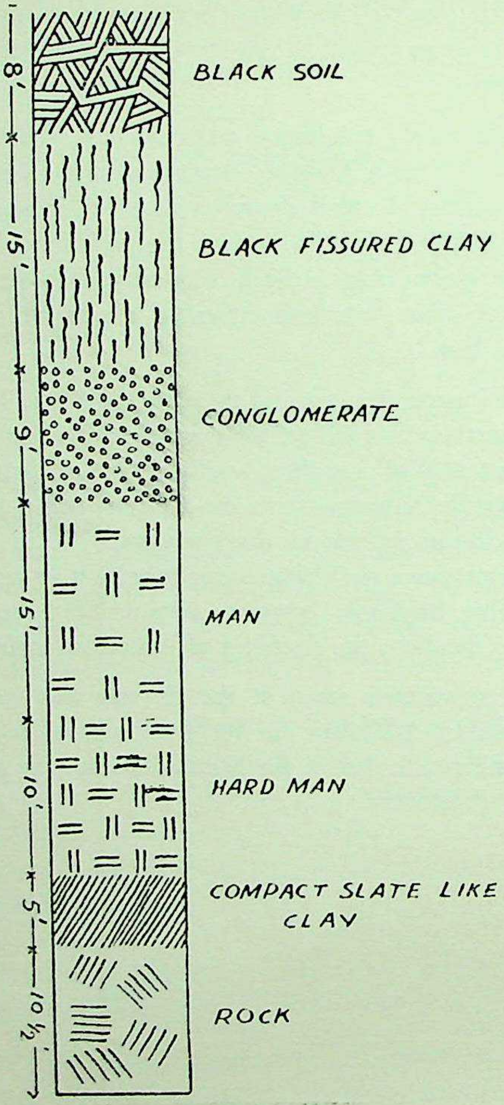
[22] LOWE, C. Van Riet, *The Pleistocene Geology and Prehistory of Uganda*, Part II ; *Prehistory*, (Geological Survey of Uganda, Memoir No. VI, England, 1952), p. 41, pl. XI.


8'
BLACK SOIL
15'
BLACK FISSURED CLAY
9'
CONGLOMERATE
15'
MAN
10'
HARD MAN
5'
COMPACT SLATE LIKE CLAY
10½'
ROCK

SECTION - BORE NO. 3
DAM SITE NO.3
GANGAPUR
SCALE VERTICAL 1 in. = 12 ft.

Fig. 4

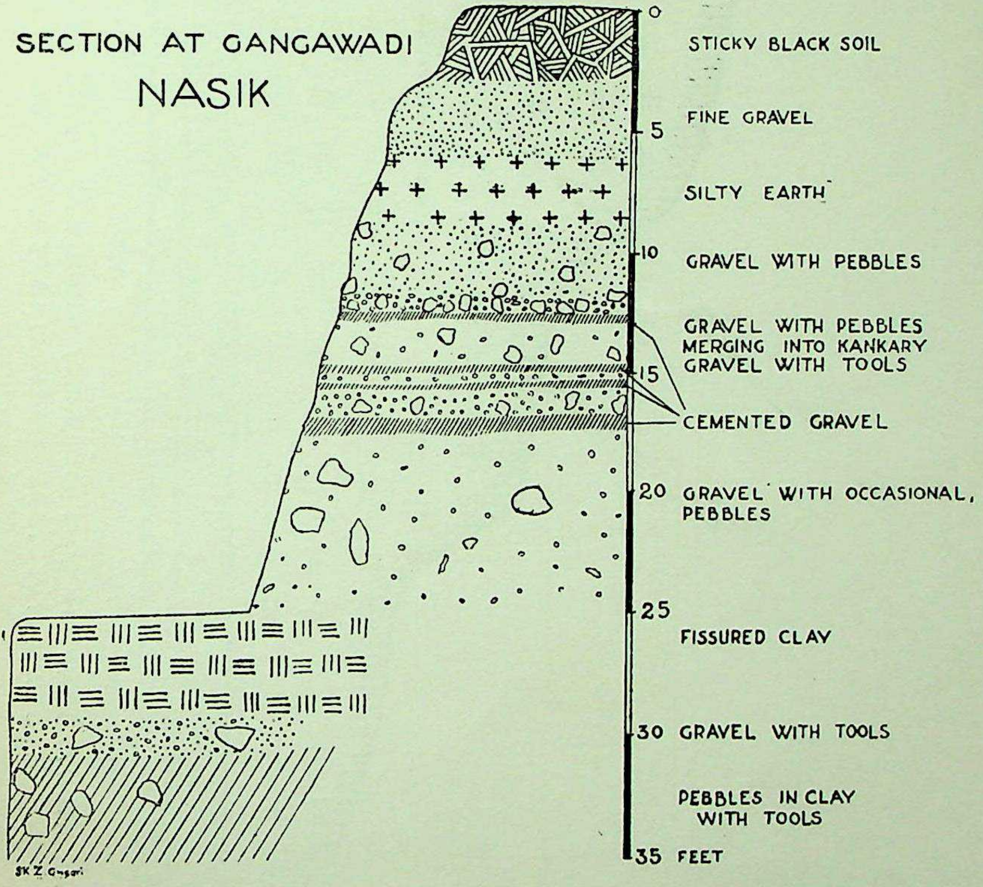
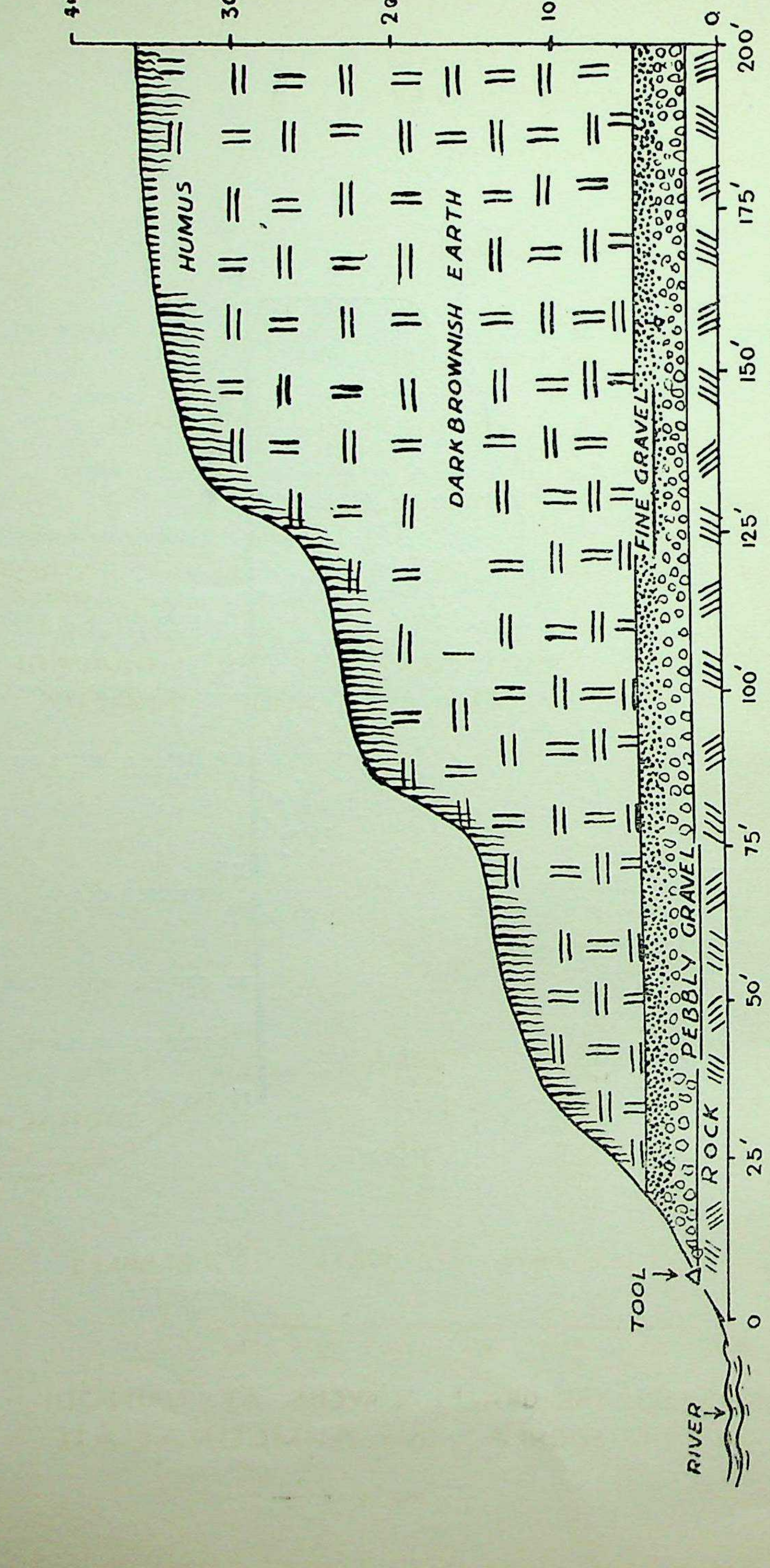
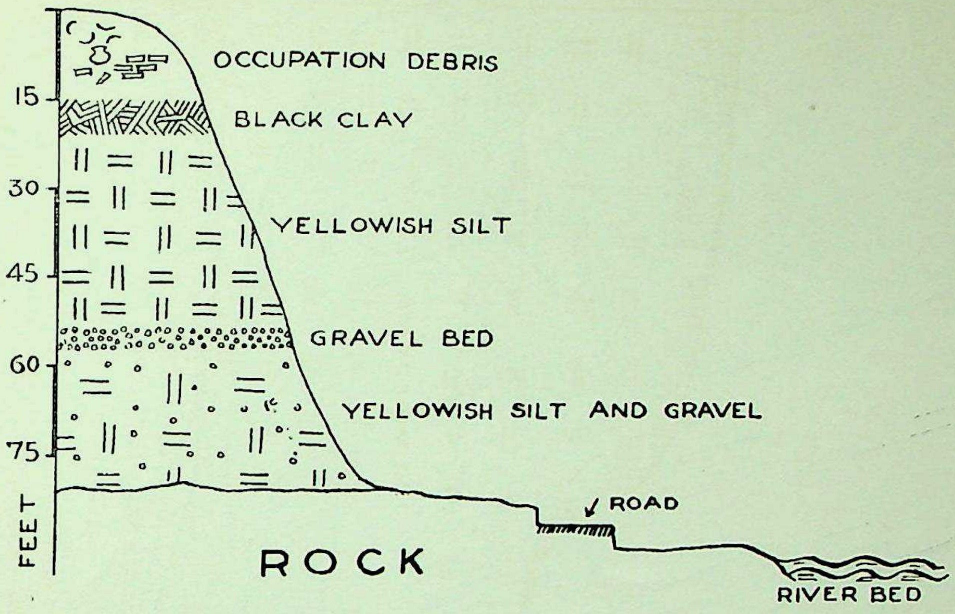

SECTION AT GANGAWADI
NASIK
0
STICKY BLACK SOIL
5
FINE GRAVEL
SILTY EARTH
10
GRAVEL WITH PEBBLES
GRAVEL WITH PEBBLES MERGING INTO KANKARY GRAVEL WITH TOOLS
15
CEMENTED GRAVEL
20
GRAVEL WITH OCCASIONAL, PEBBLES
25
FISSURED CLAY
30
GRAVEL WITH TOOLS
PEBBLES IN CLAY WITH TOOLS
35 FEET
SK Z. Gnsari

Fig. 5.


40
30
20
10
0
200'
175'
150'
125'
100'
75'
50'
25'
0
HUMUS
DARK BROWNISH EARTH
FINE GRAVEL
PEBBLY GRAVEL
ROCK
TOOL
RIVER

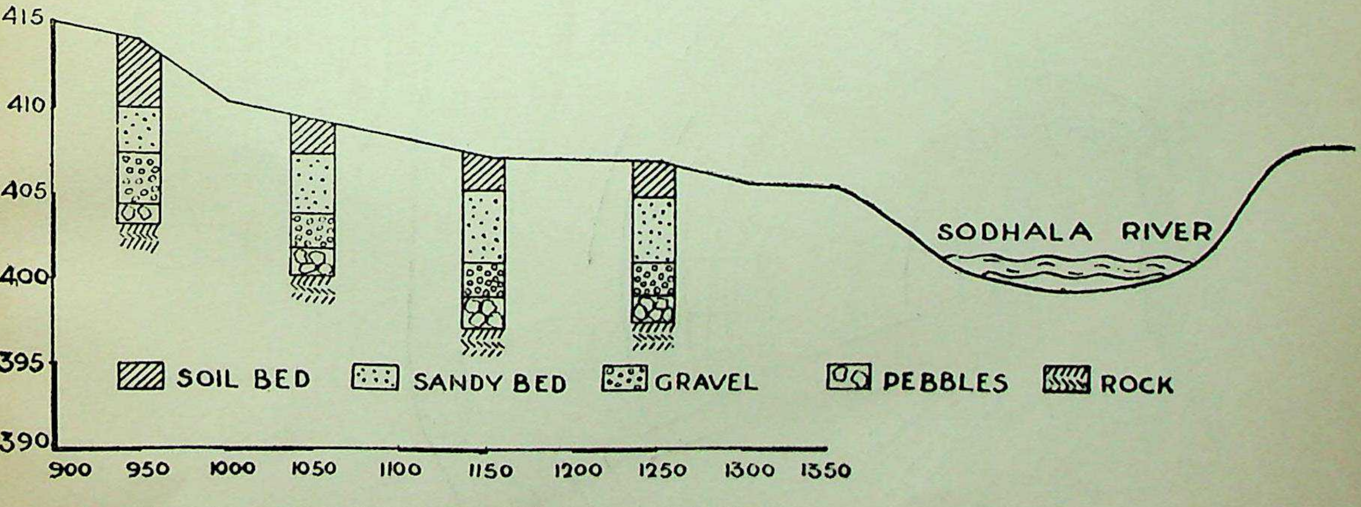
SECTION ON THE RIGHT BANK OF THE GODAVARI OPPOSITE JALALPUR (NASIK) SHOWING THE TOOL BEARING LOCALITY III
(18-2-52)

Fig. 9


OCCUPATION DEBRIS
BLACK CLAY
YELLOWISH SILT
GRAVEL BED
YELLOWISH SILT AND GRAVEL
15
30
45
60
75
FEET
ROCK
ROAD
RIVER BED

SECTION – RIGHT BANK OF THE GODAVARI
AT MATI CHI GADHI NASIK

Fig. 10


415
410
405
400
395
390
900
950
1000
1050
1100
1150
1200
1250
1300
1350
SODHALA RIVER
SOIL BED
SANDY BED
GRAVEL
PEBBLES
ROCK

SECTION– SHOWING THE GRAVEL LAYERS AT GUNODI
ON THE SODHLA Dist. AHMEDNAGAR.

Fig. 11.

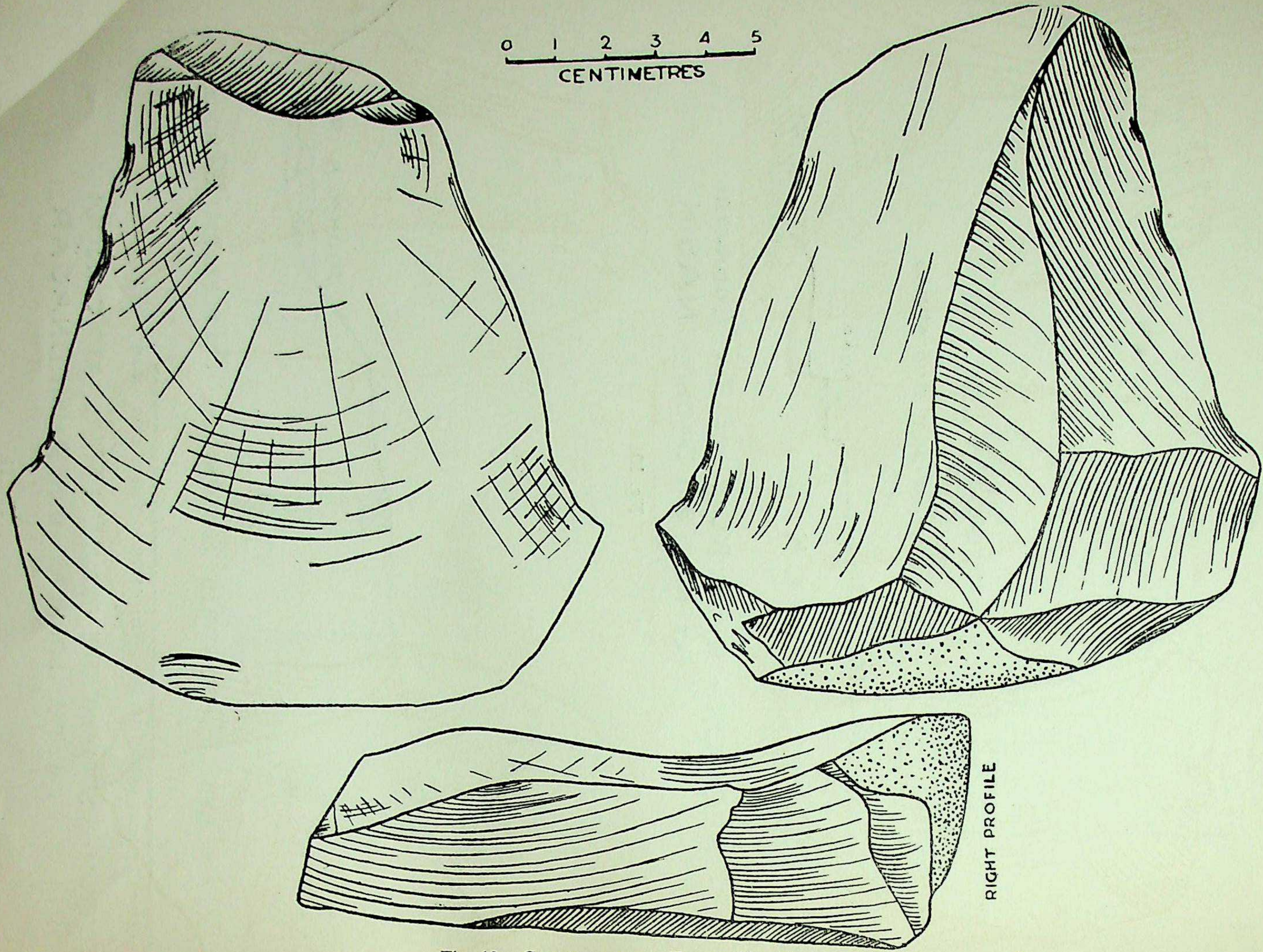

0 1 2 3 4 5
CENTIMETRES
RIGHT PROFILE

Fig. 12. CLACTONIAN-LIKE FLAKE, No. 11.

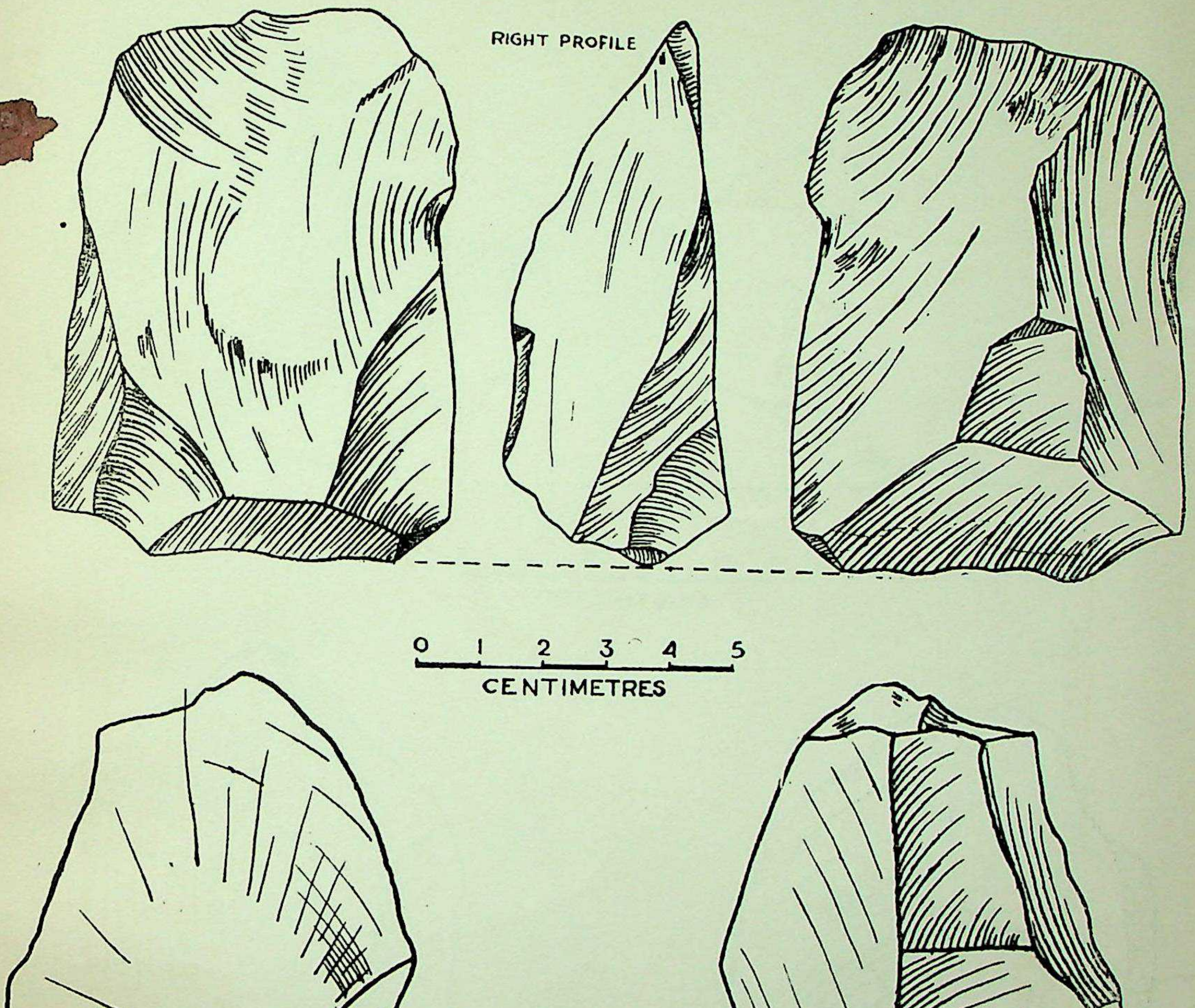

RIGHT PROFILE
0 1 2 3 4 5
CENTIMETRES

Fig. 13 Clactonian-like Flakes, No. 41 bottom; No. 33 top.

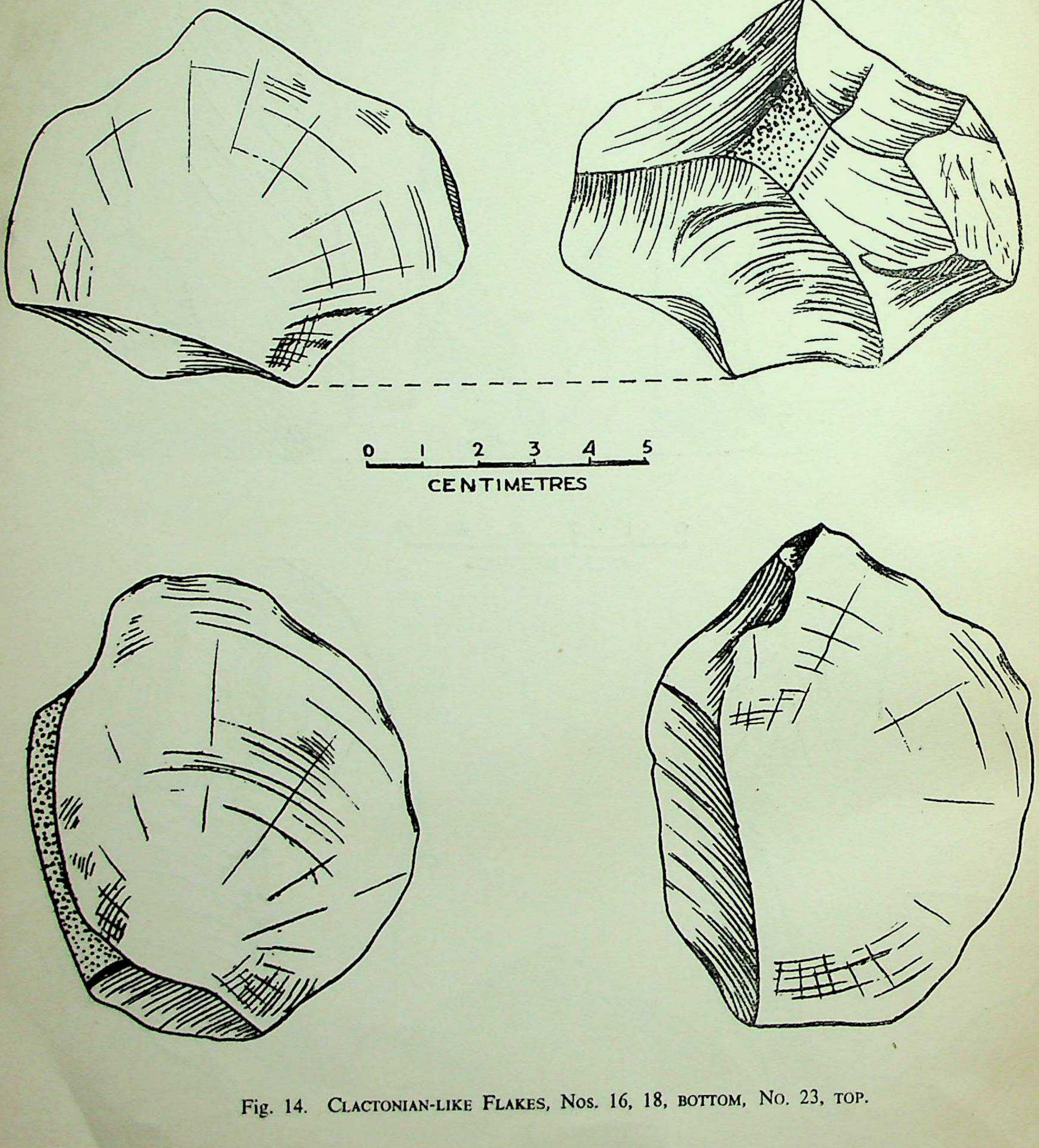

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Fig. 14. Clactonian-like Flakes, Nos. 16, 18, bottom, No. 23, top.

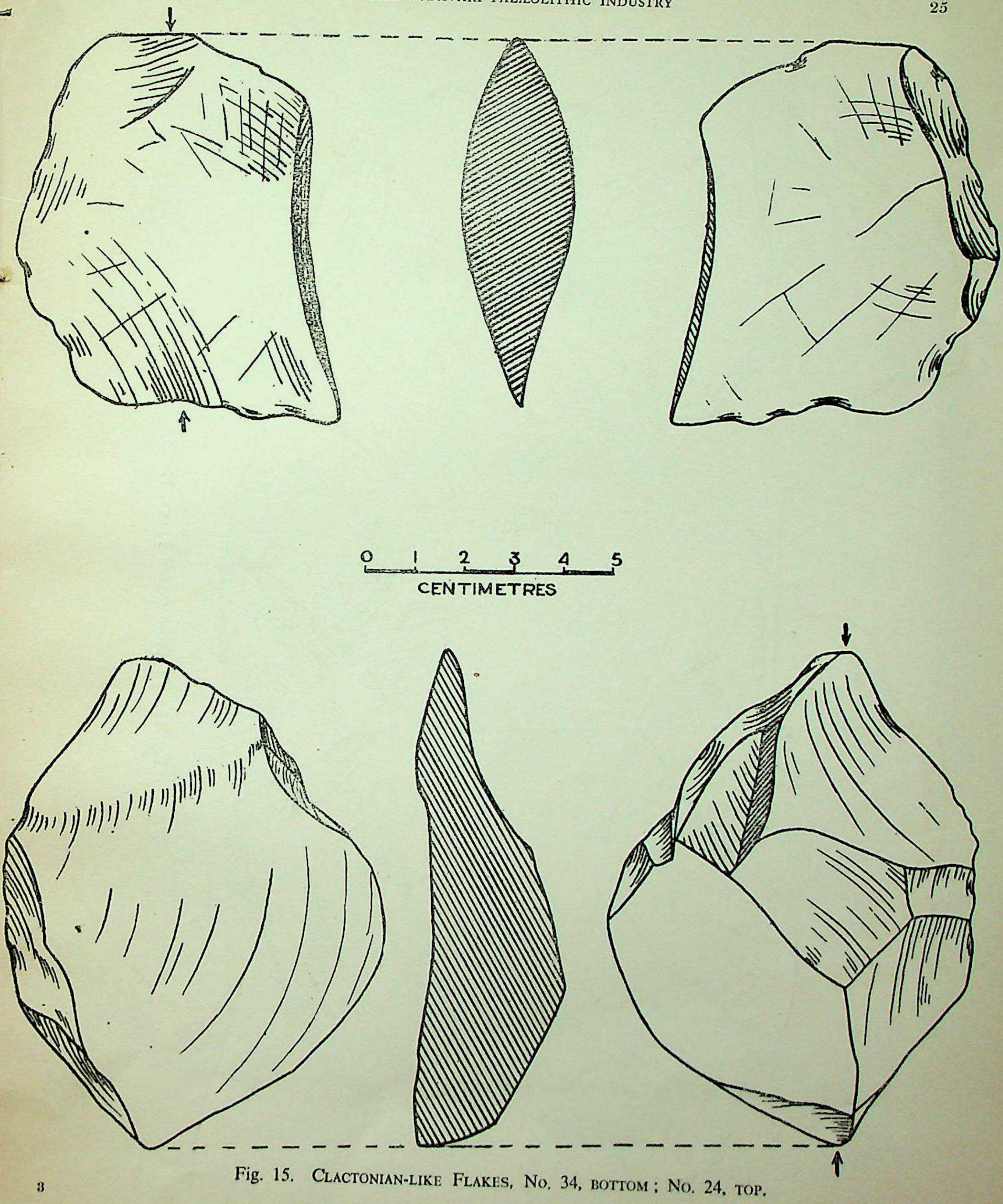
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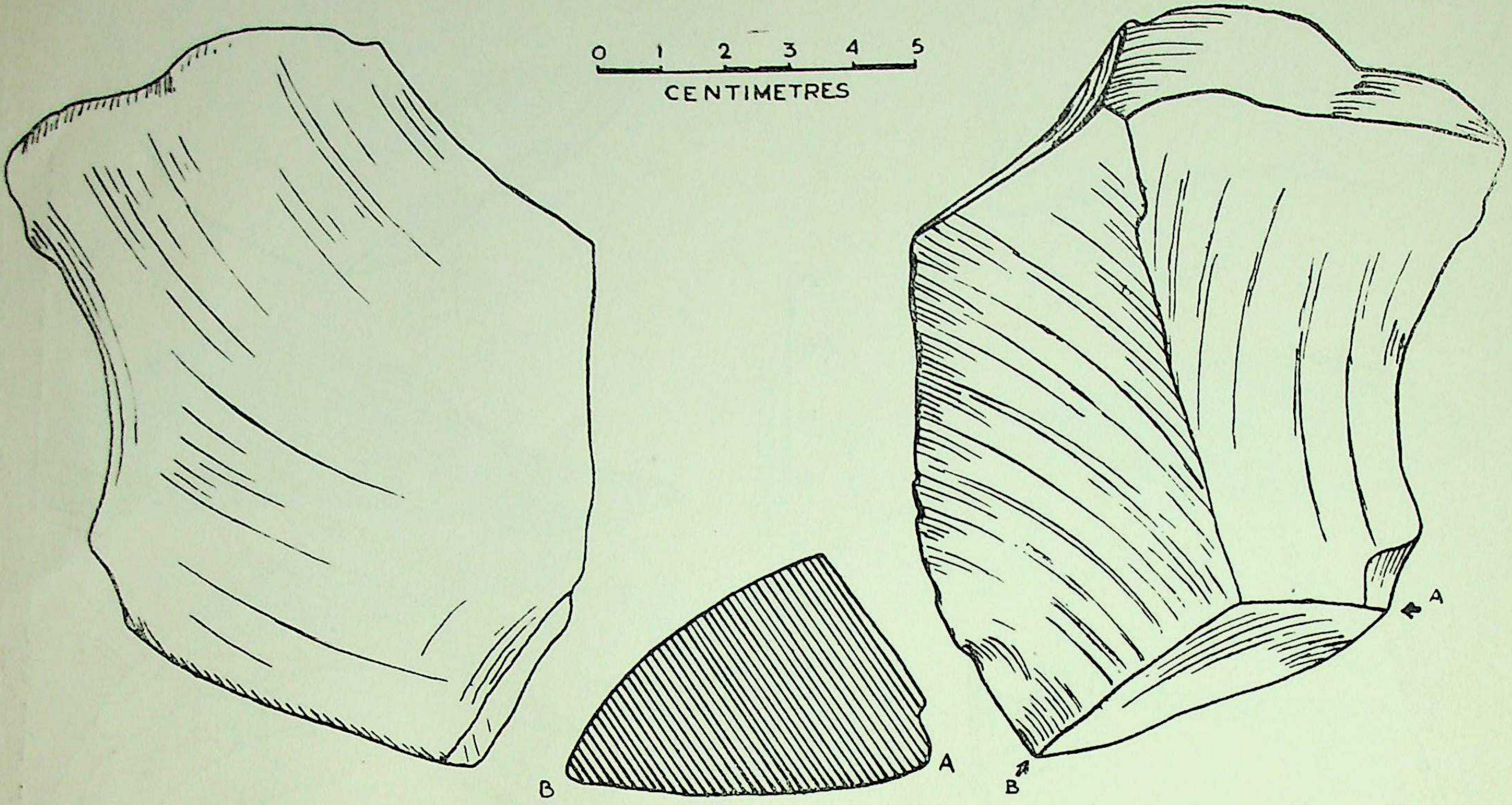
Fig. 15. Clactonian-like Flakes, No. 34, bottom ; No. 24, top.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CENTIMETRES
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A
B

Fig. 16. Clactonian-like Flake, No. 5.

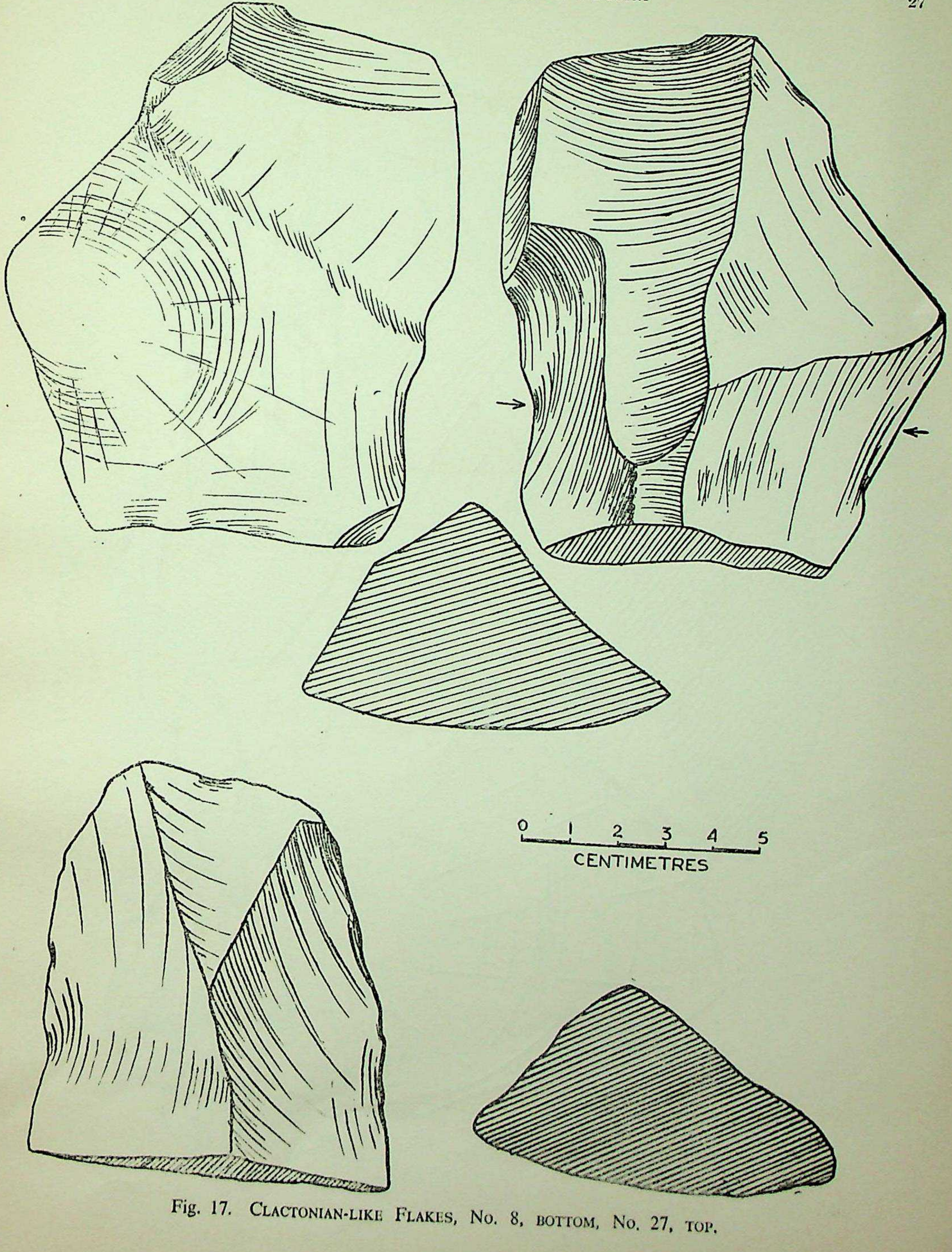
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Fig. 17. Clactonian-like Flakes, No. 8, bottom, No. 27, top.

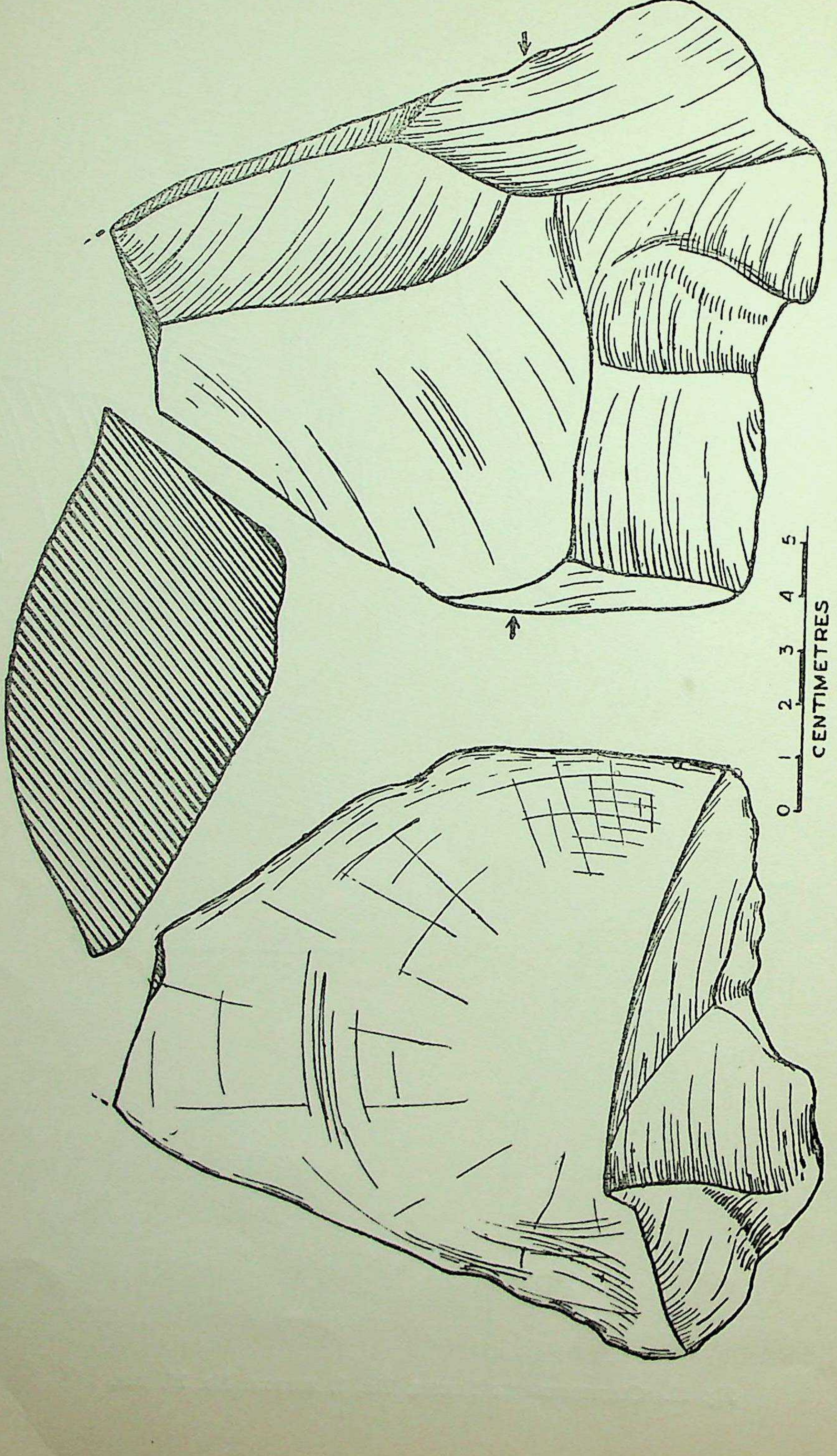
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Fig. 18. Clactonian-like Flake, No. 37.

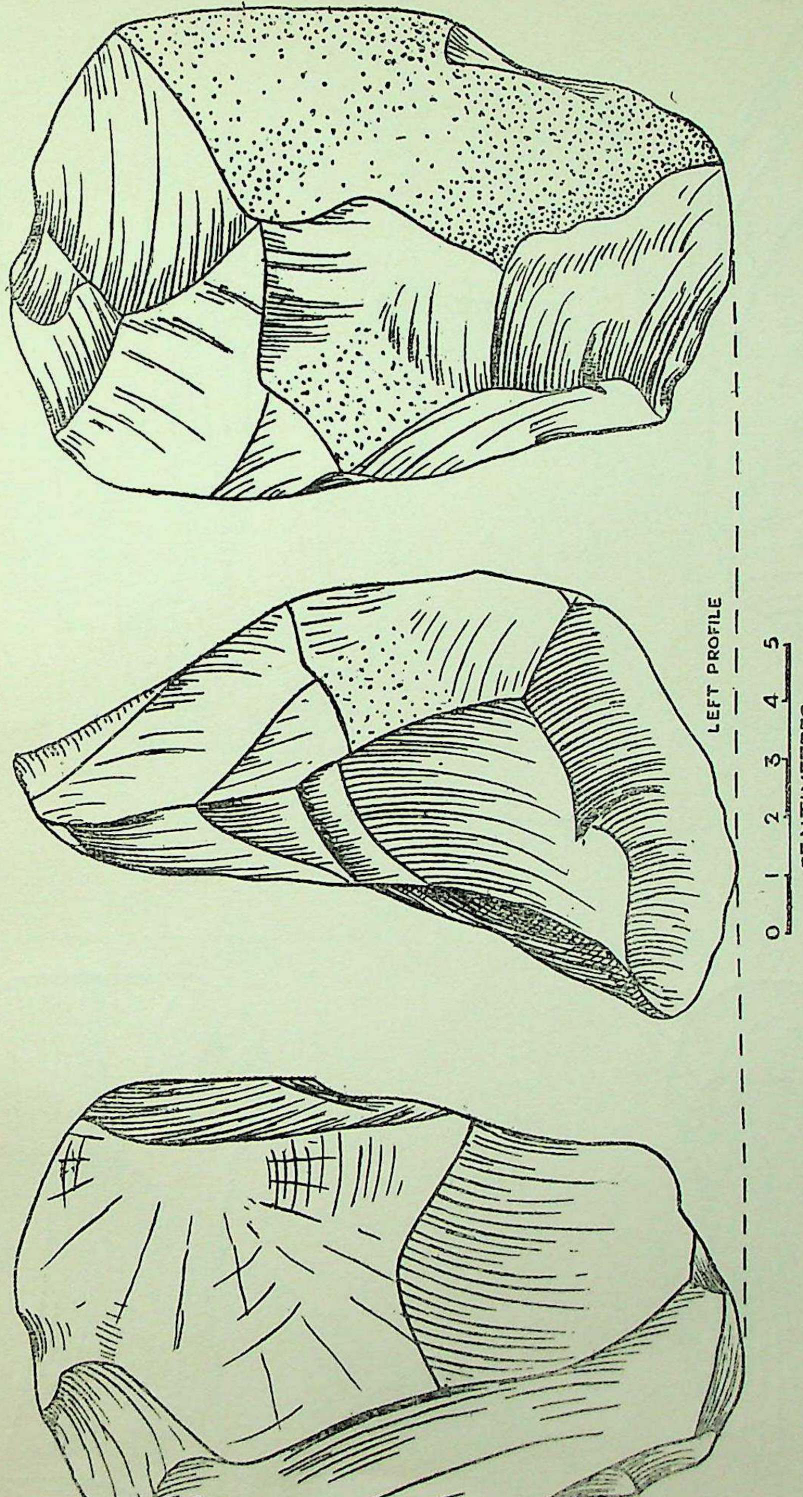
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Fig. 19. Clactonian-like Flake, or Cleaver, No. 55.

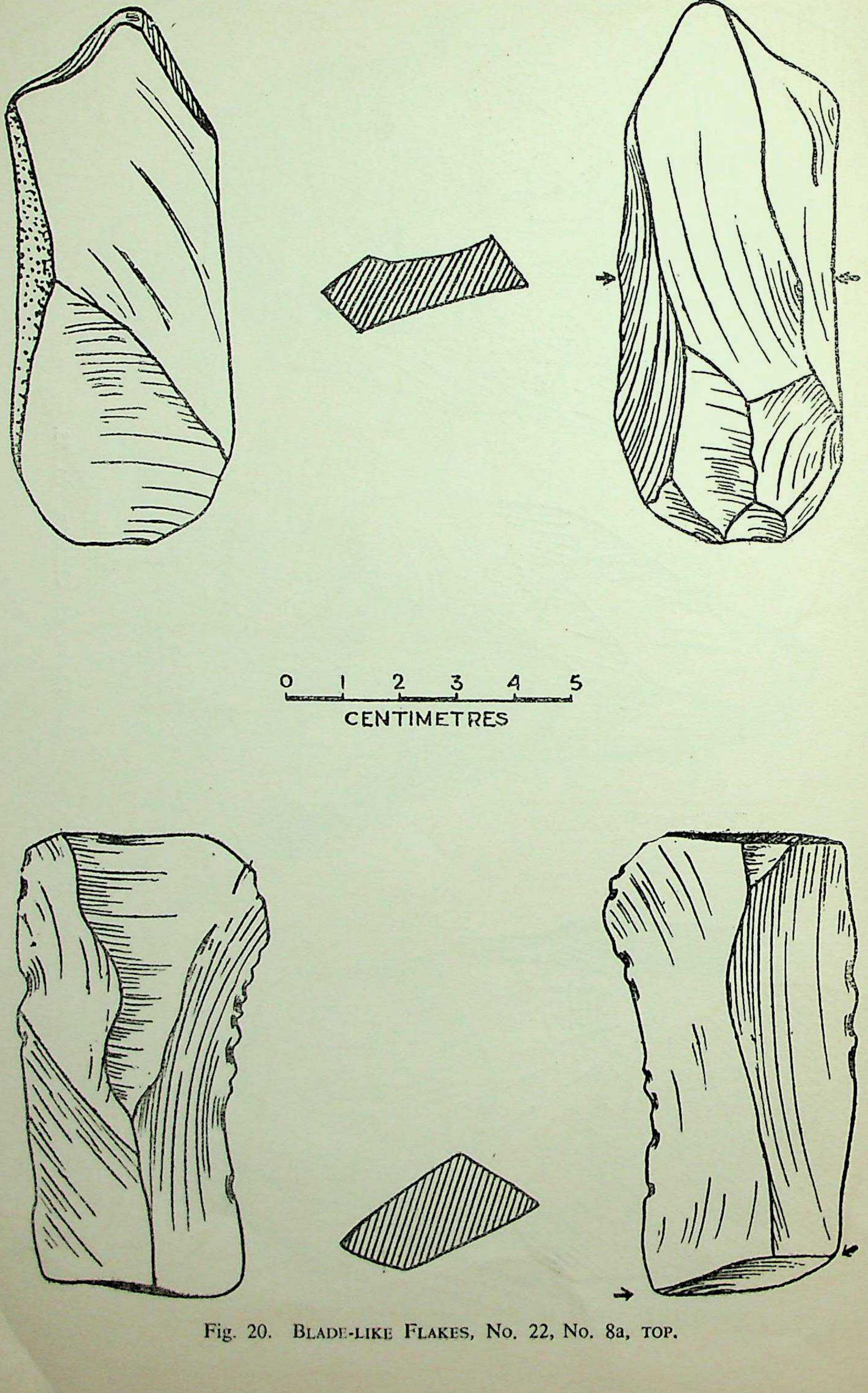
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Fig. 20. Blade-like Flakes, No. 22, No. 8a, top.

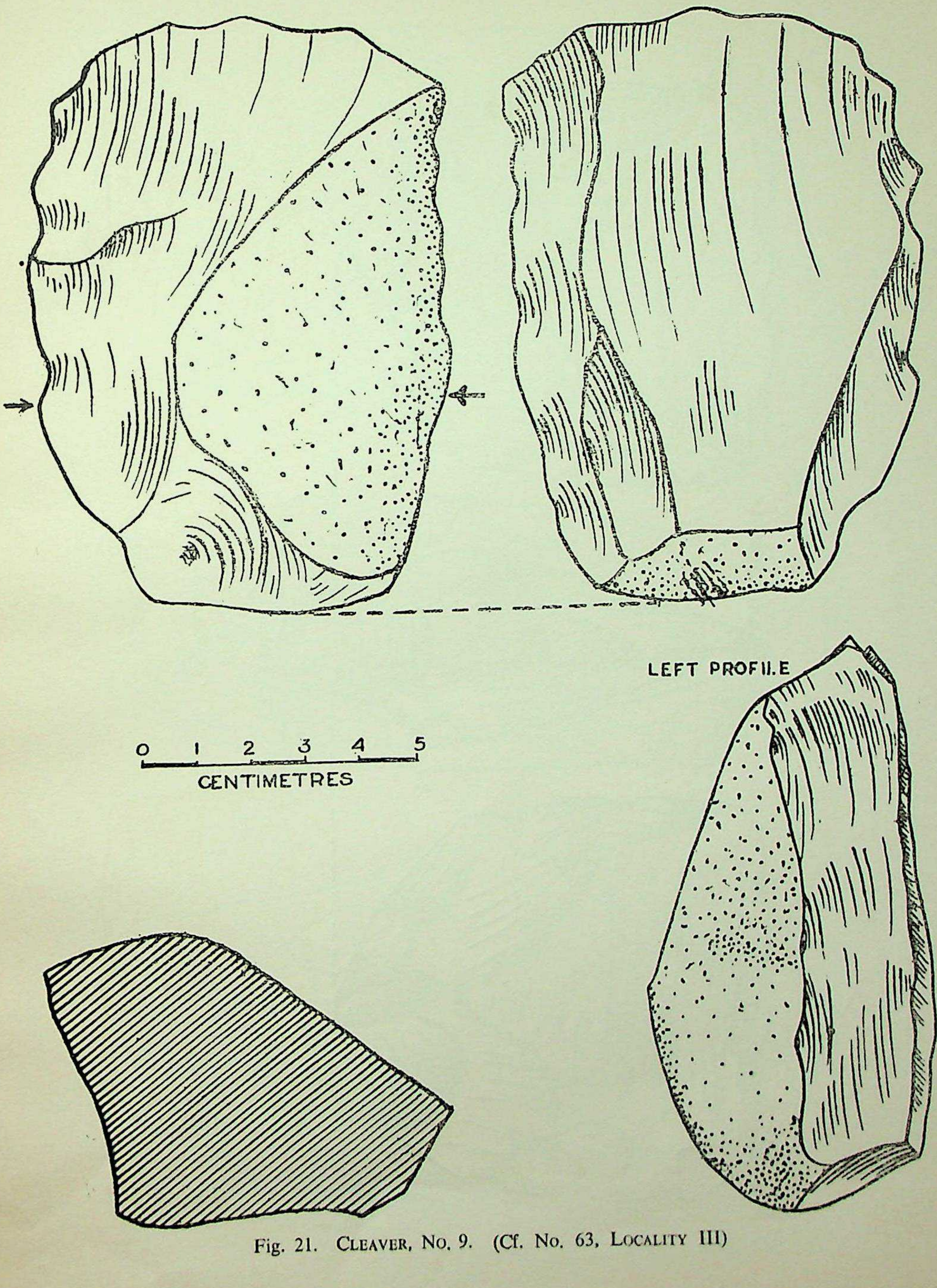
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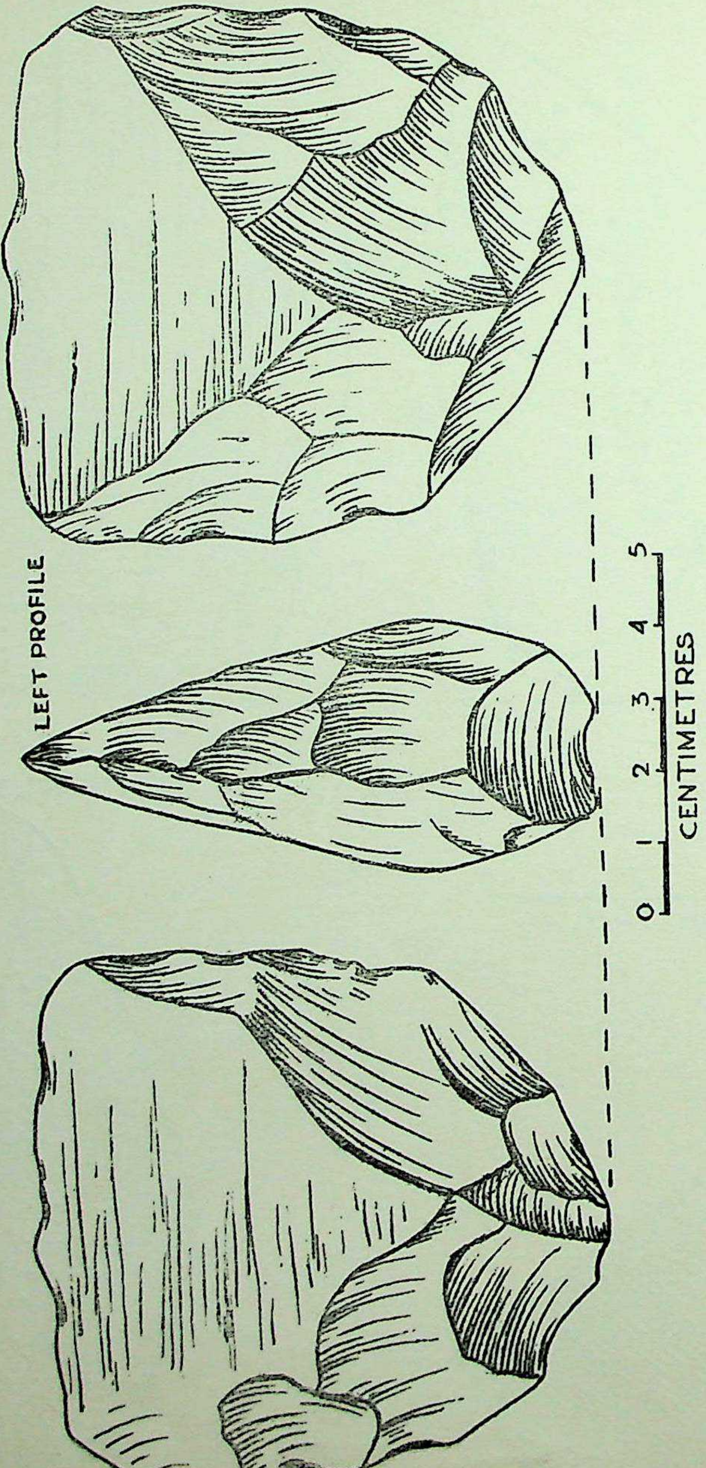
Fig. 21. CLEAVER, NO. 9. (Cf. No. 63, LOCALITY III)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CENTIMETRES

Fig. 22. Cleaver, No. 28.

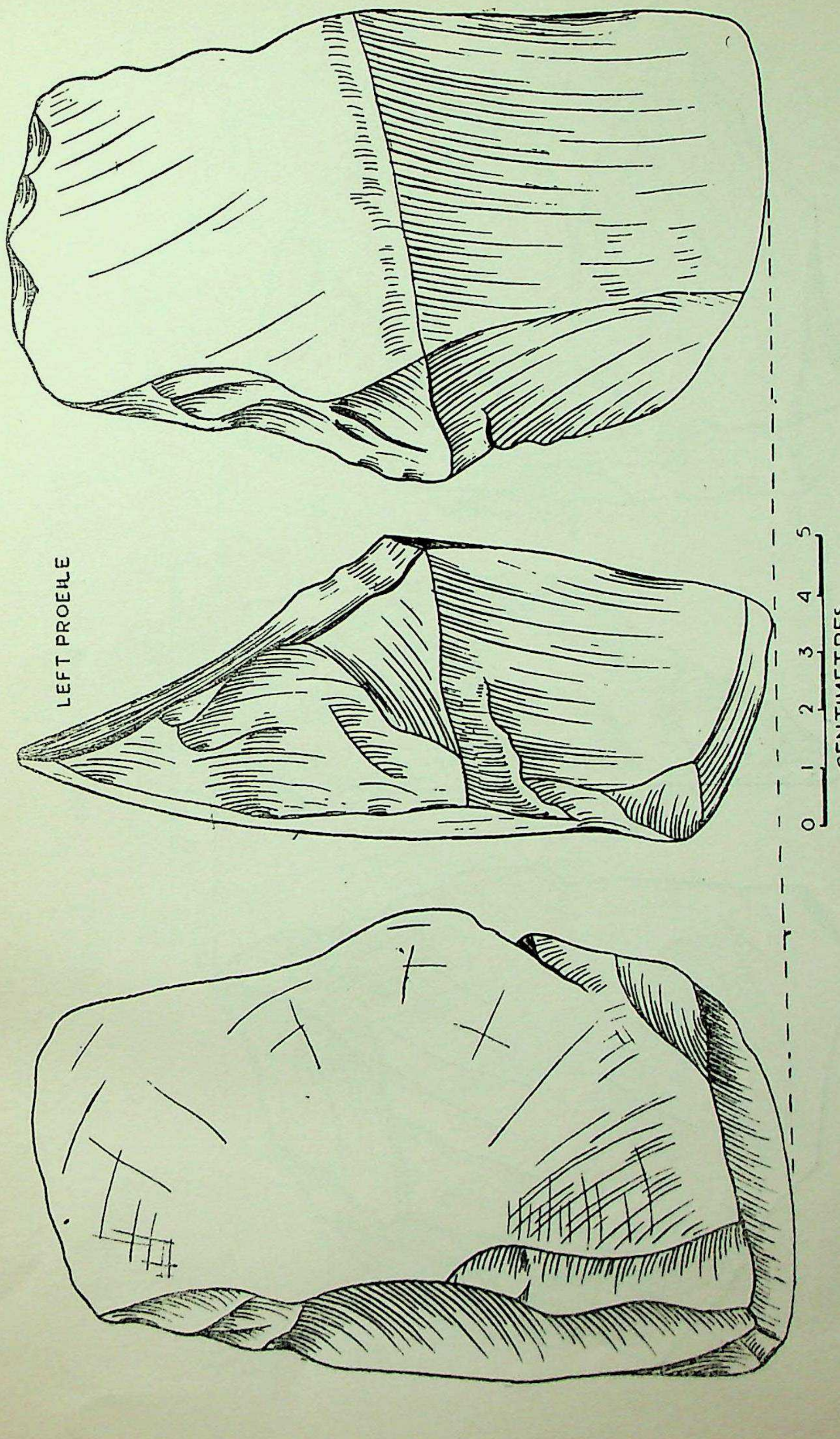
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Fig. 23. CLEAVER, No. 36.

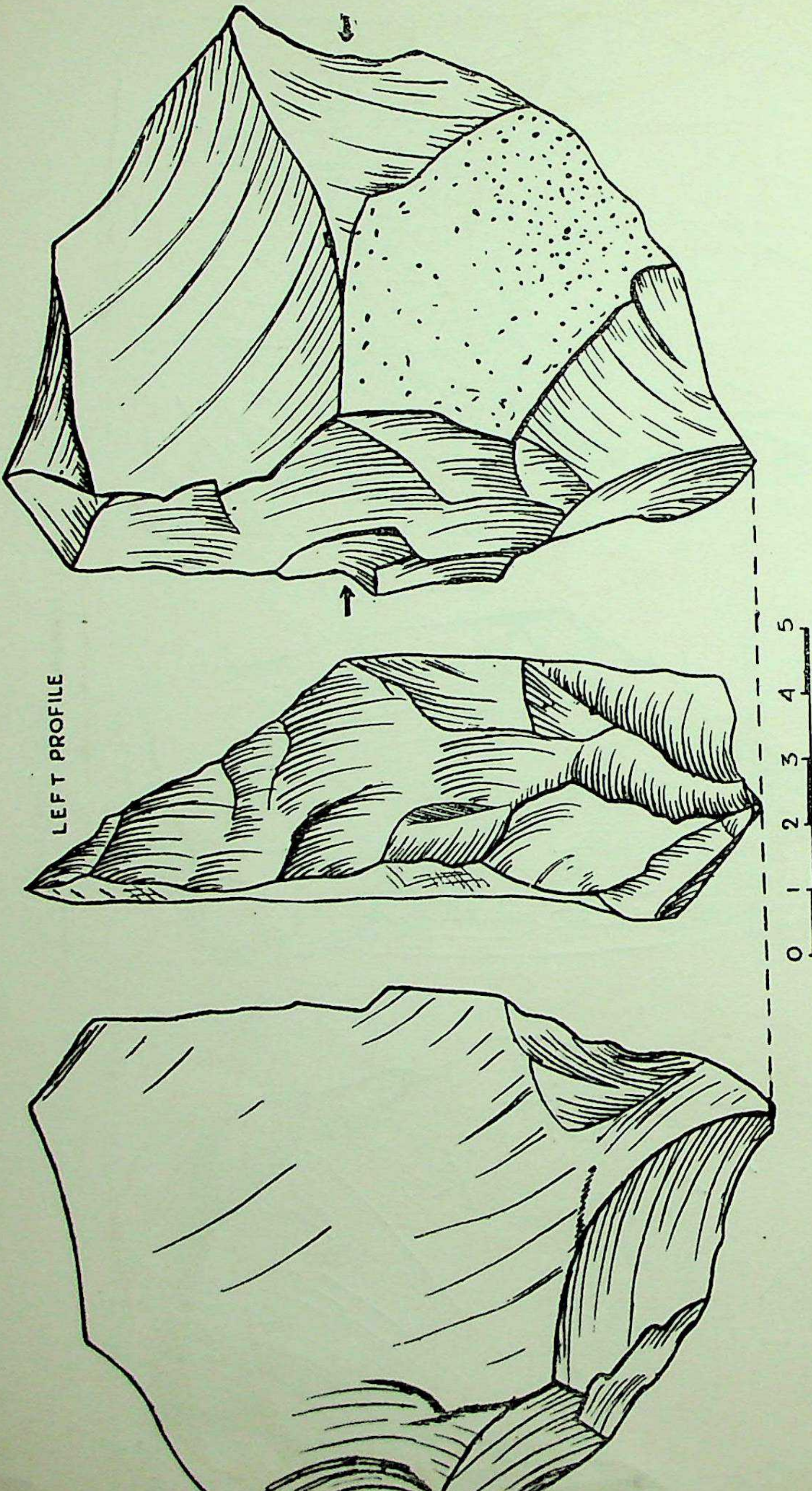
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Fig. 24. Cleaver, No. 1.

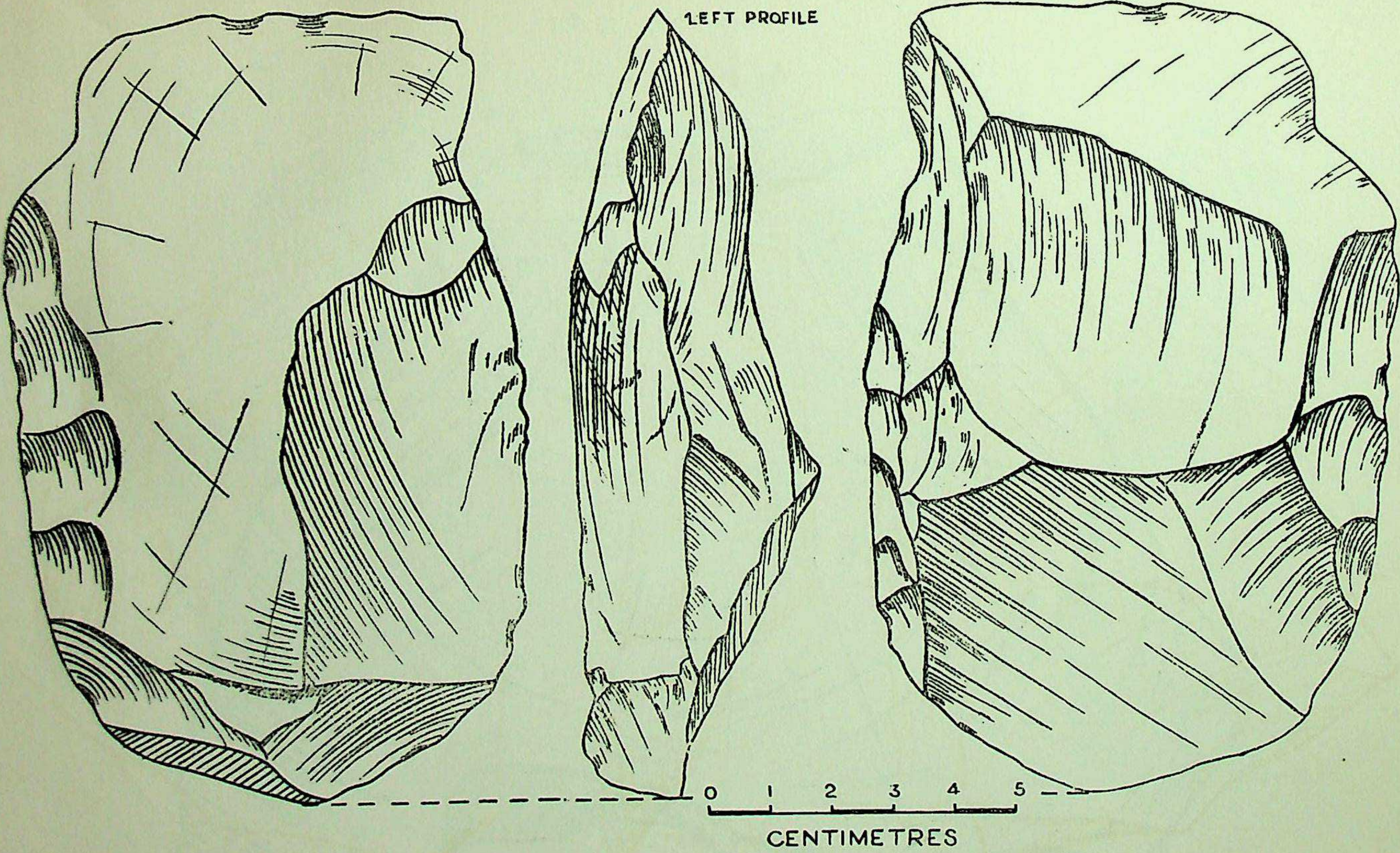
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Fig. 25. Cleaver, No. 13.

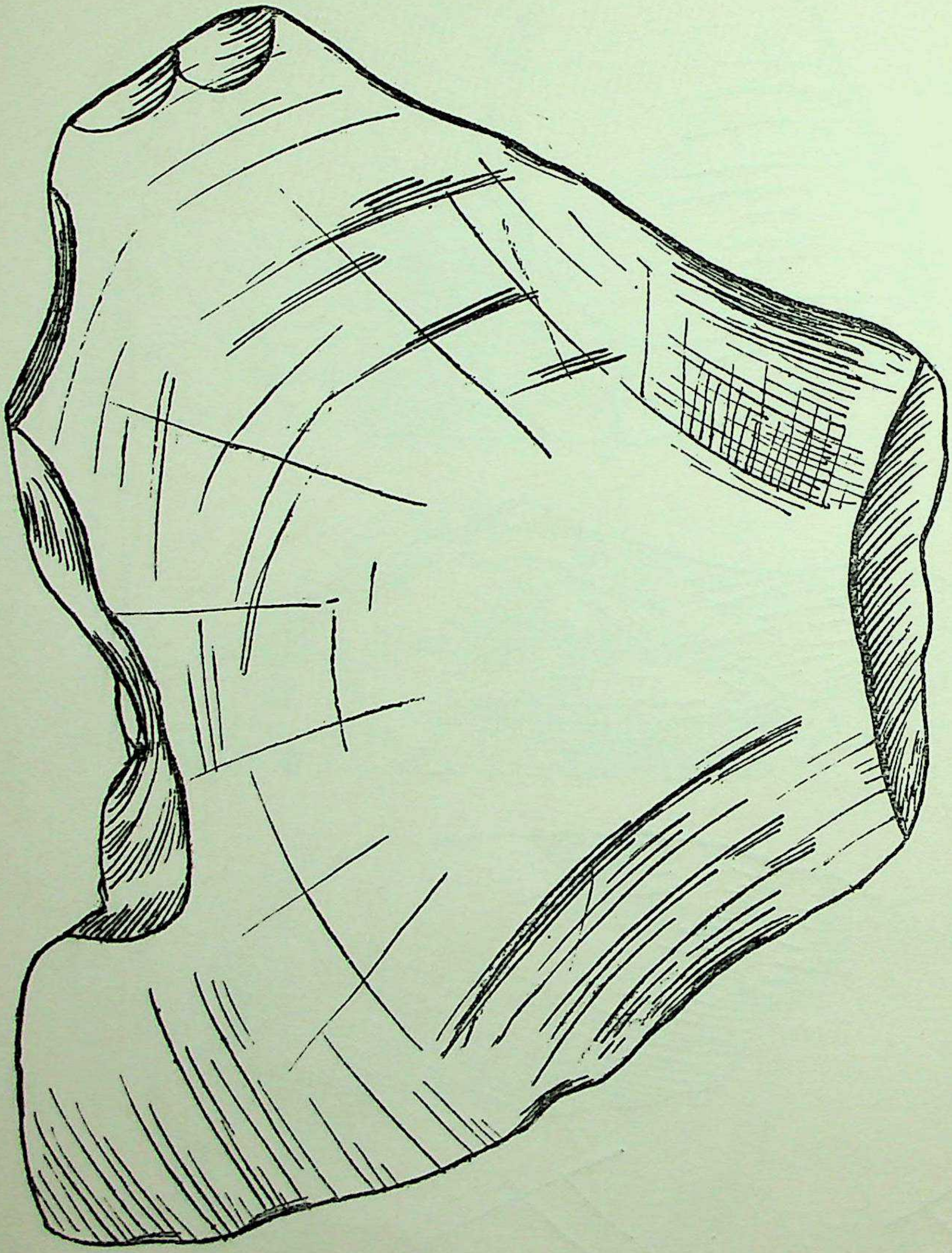

Fig. 26. Cleaver, No. 15.

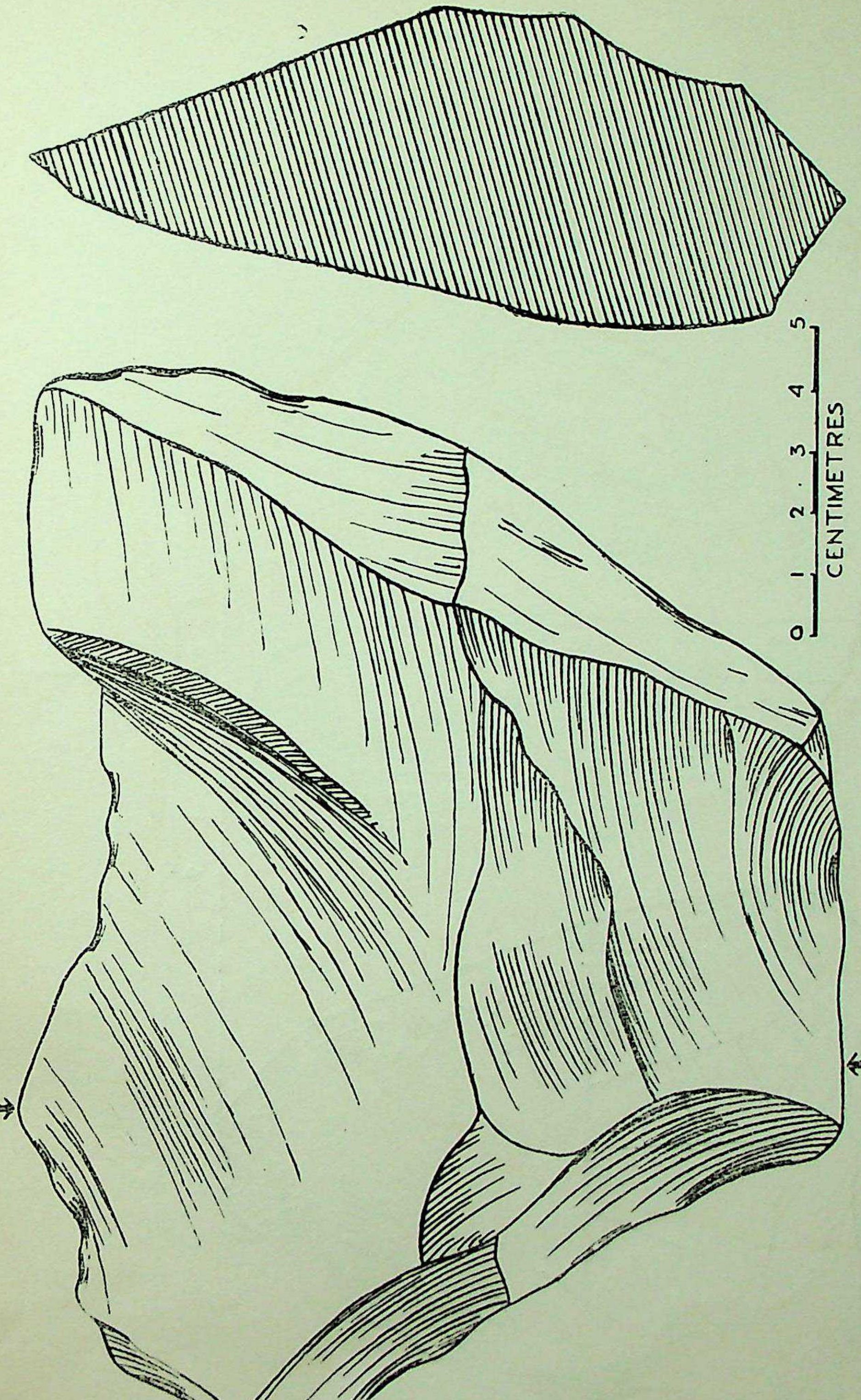
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Fig. 26a. CLEAVER, No. 15.

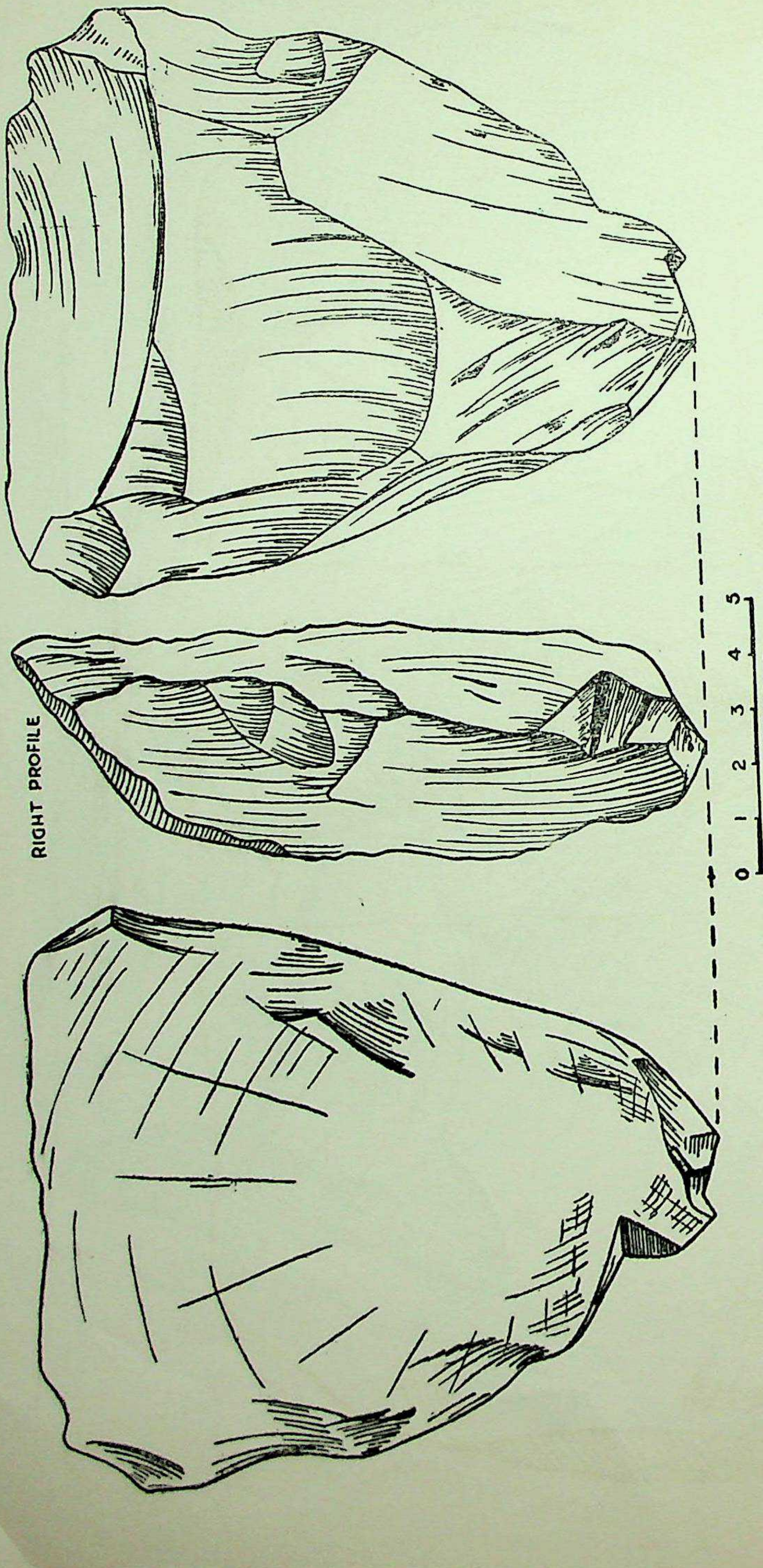
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Fig. 27. Cleaver, No. 53.

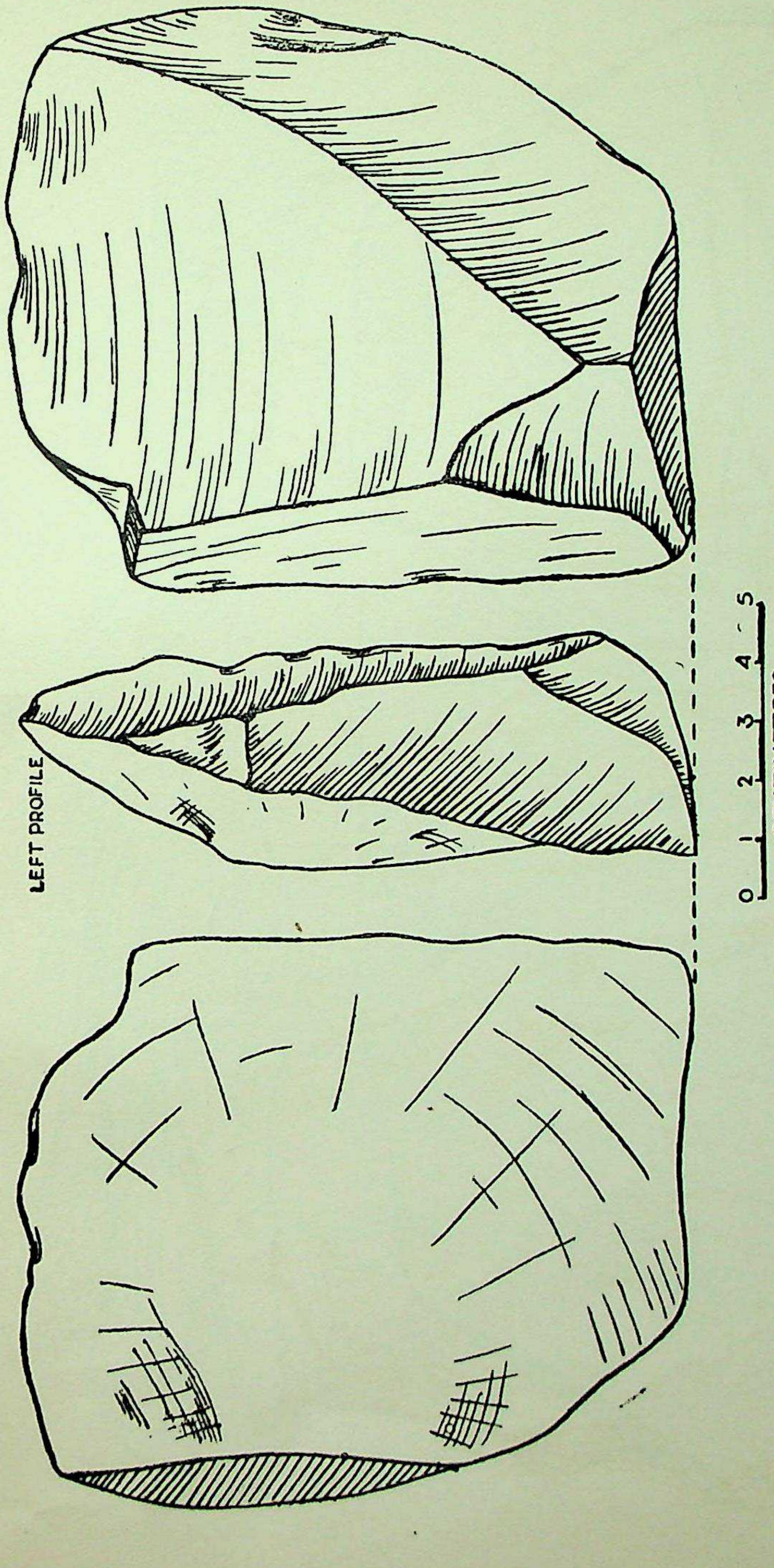
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Fig. 28. CLEAVER, No. 38.

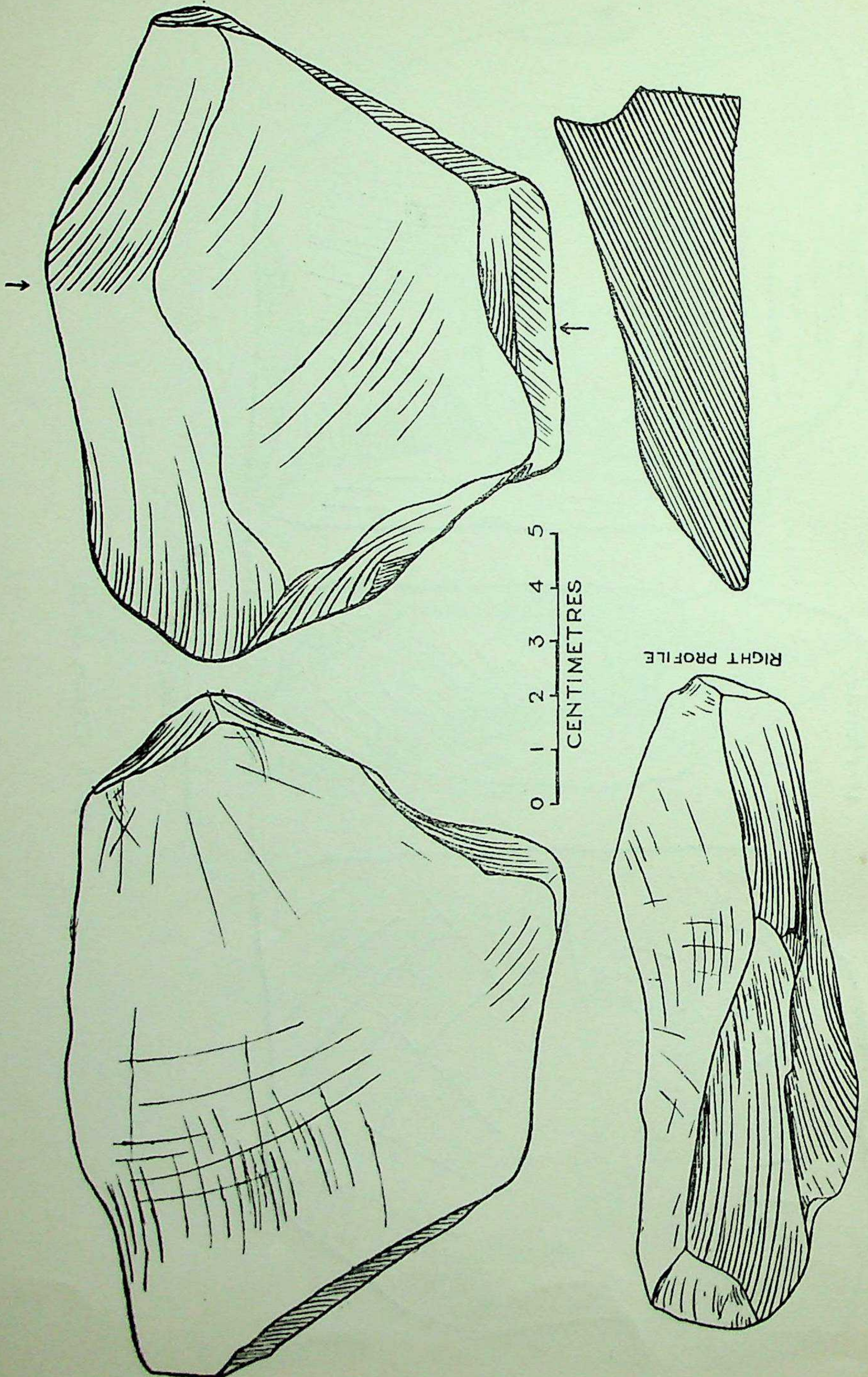
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Fig. 29. Side Scraper, No. 2.

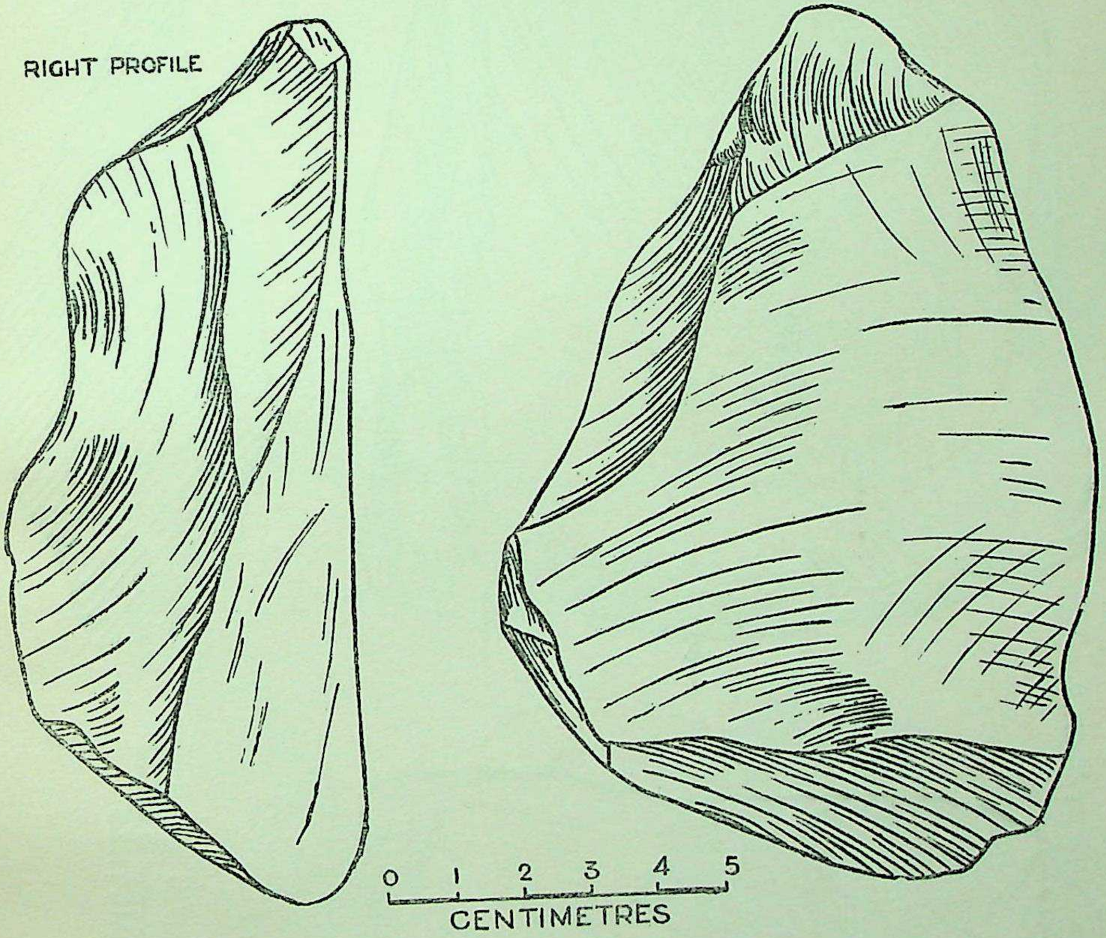
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Fig. 30. Side Scraper, No. 44.

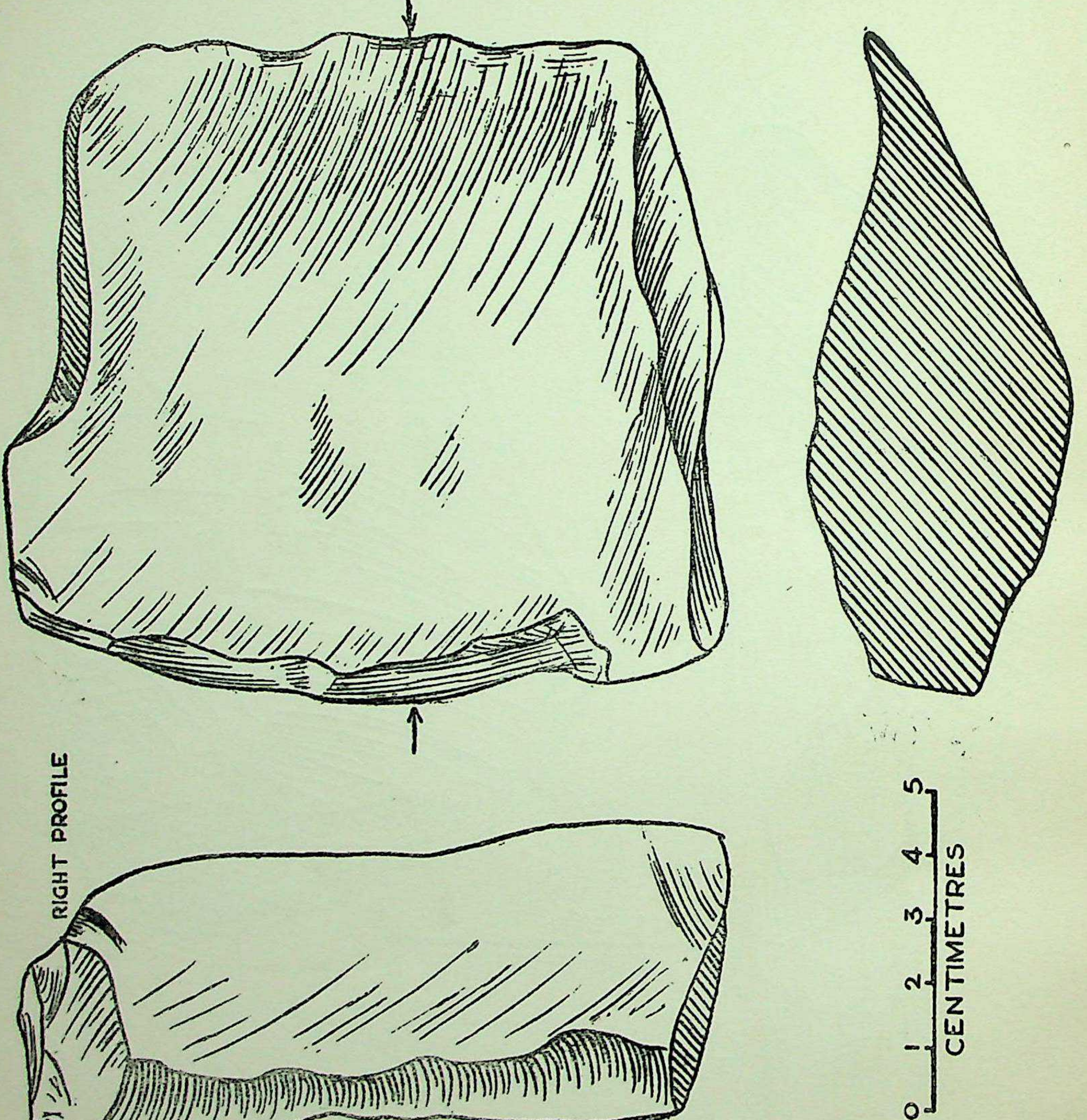
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Fig. 31. Side Scraper, No. 61.

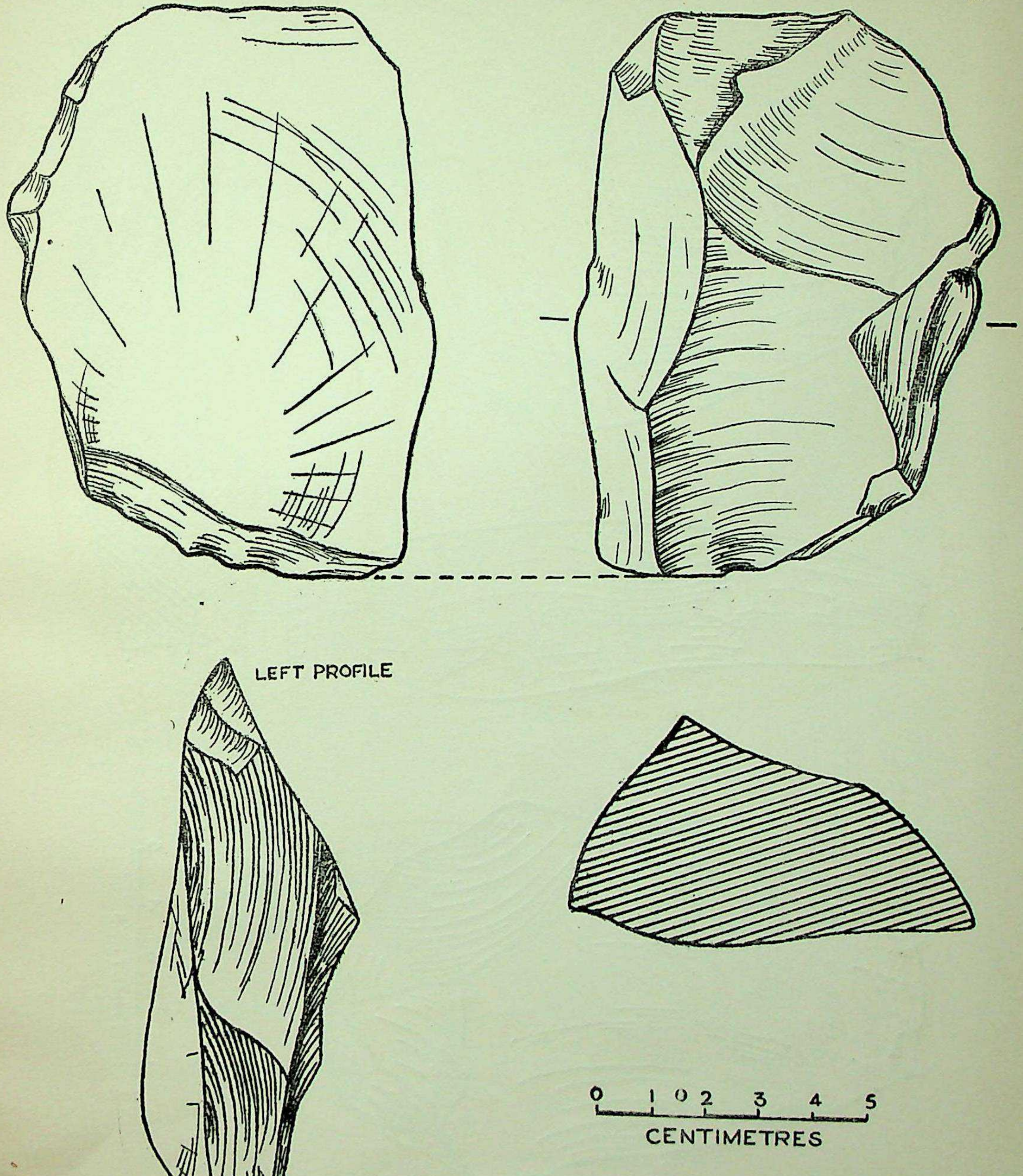
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Fig. 32. Side Scraper, No. 43.

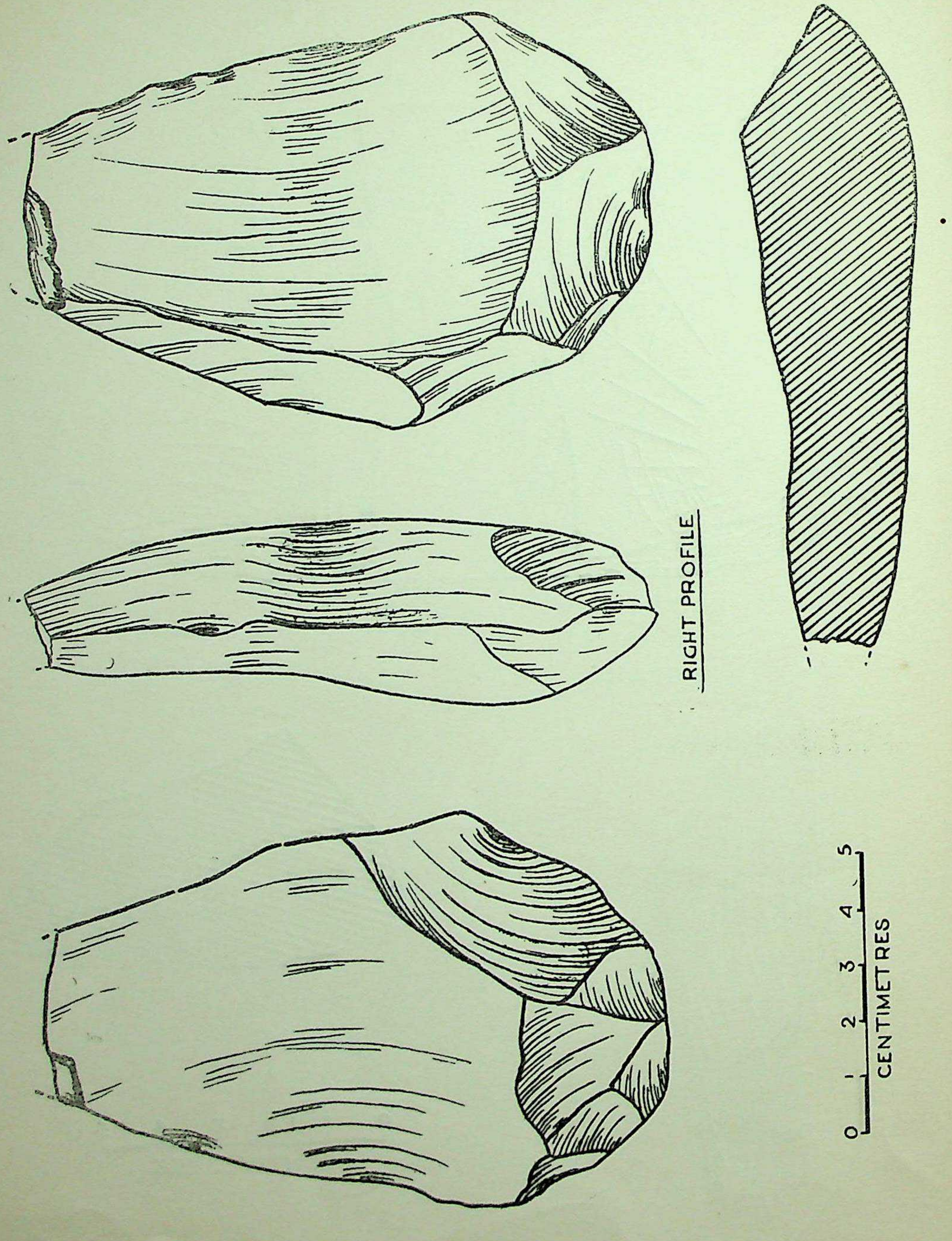
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Fig. 33. SIDE SCRAPER-CUM-HAND-AXE, No. 40.

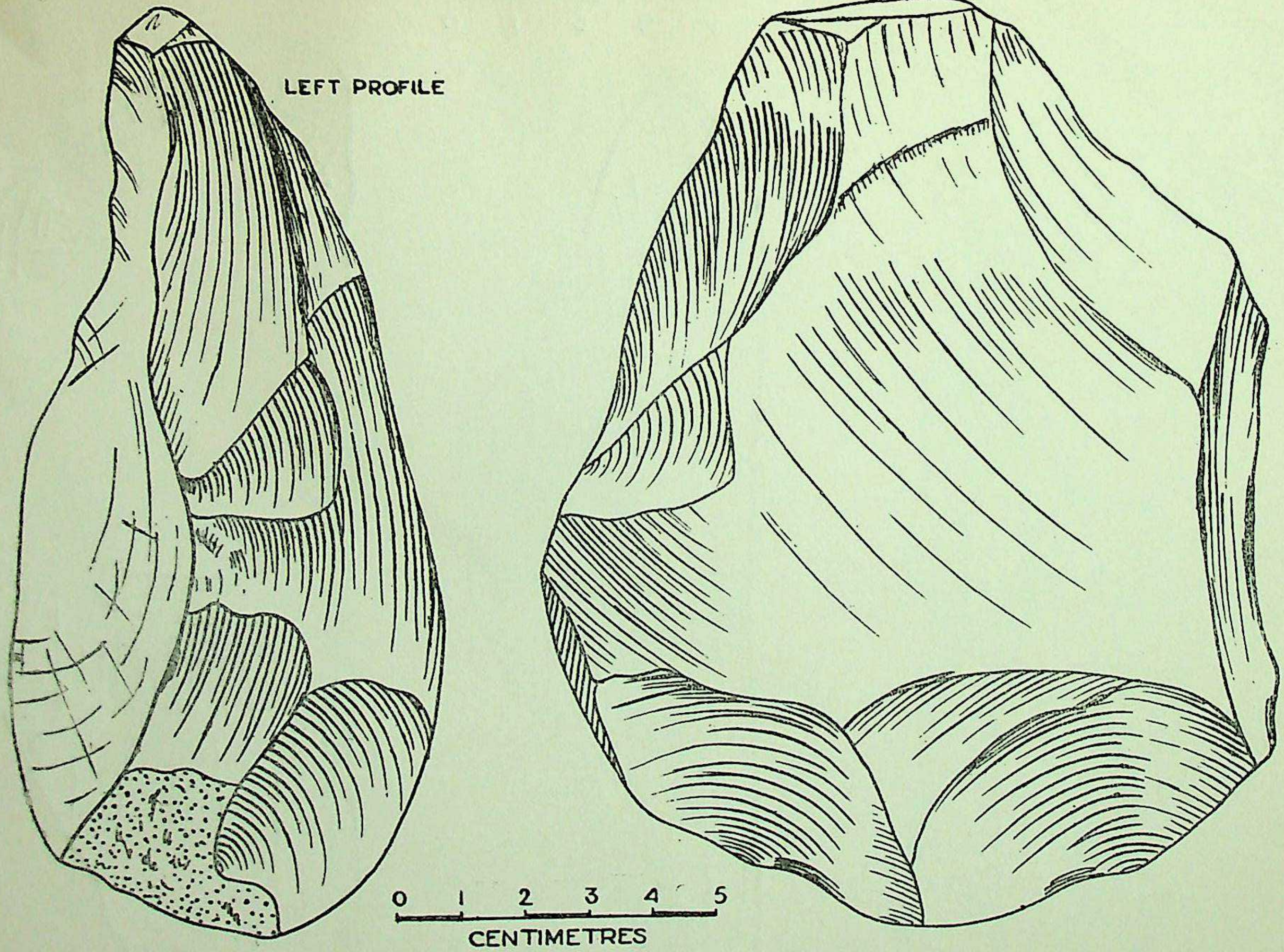
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Fig. 34. Side Scraper or Chopper-cum-hand-axe, No. 31.

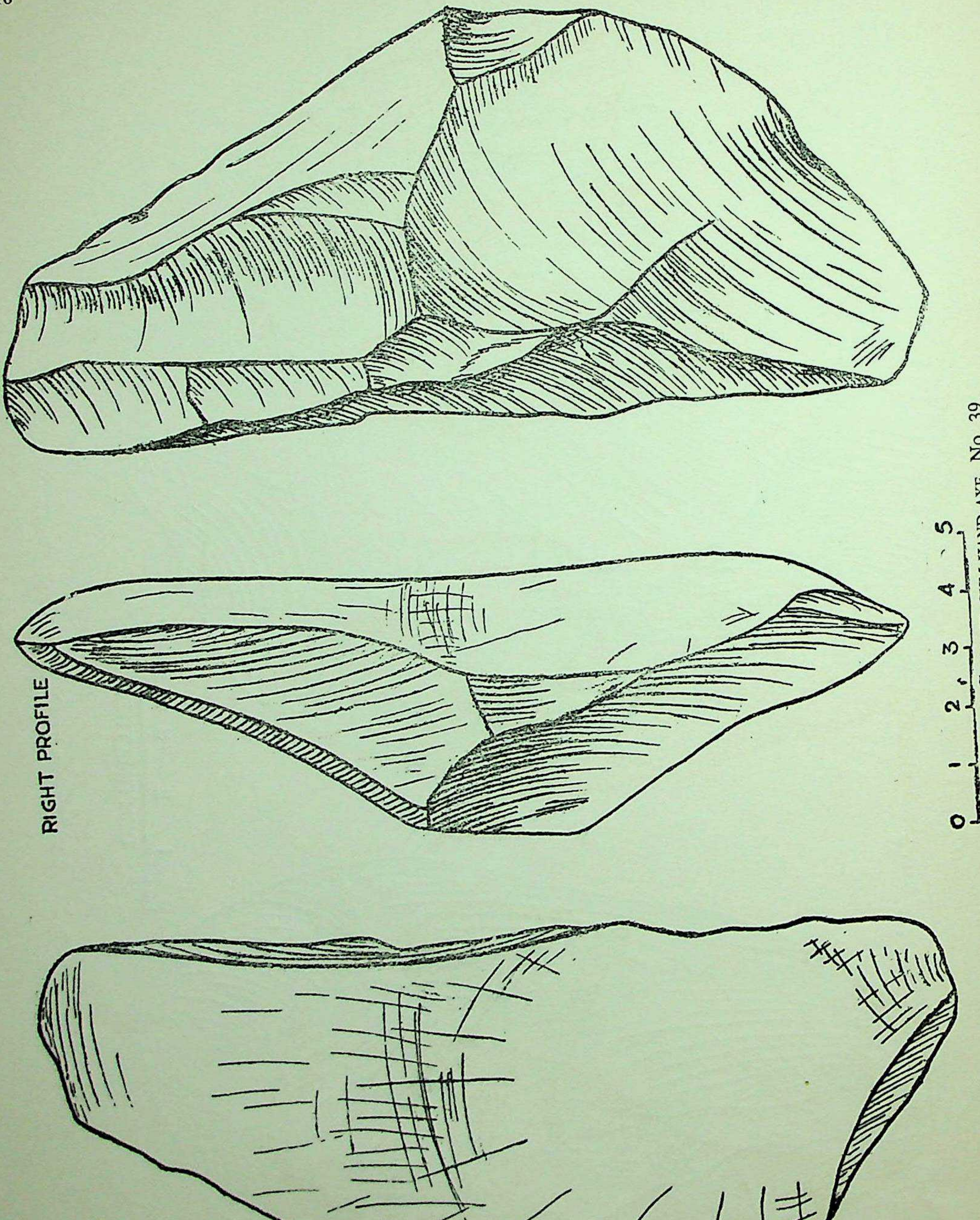
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Fig. 35. Side Scraper or Chopper-cum-hand-axe, No. 39.

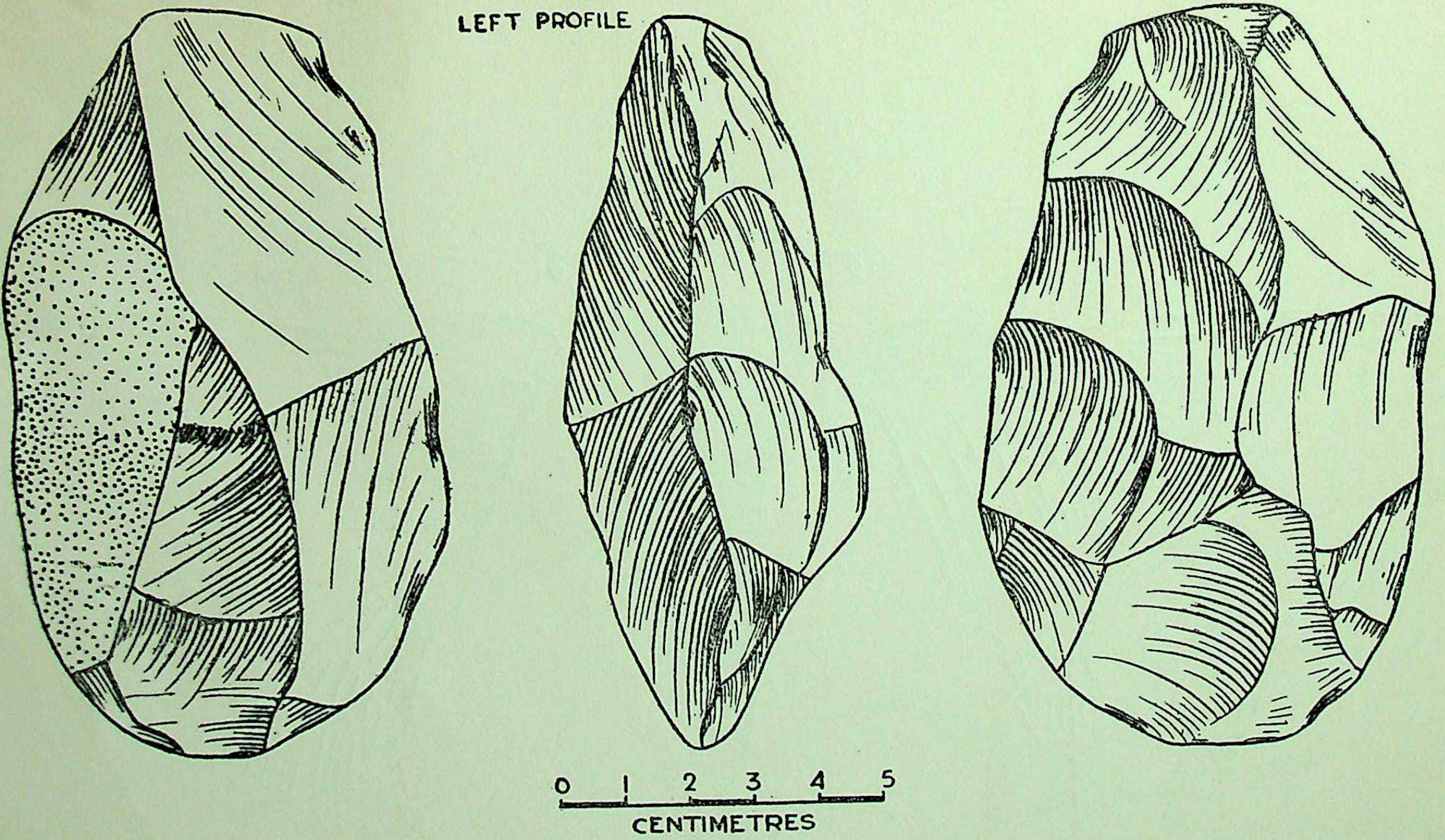
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Fig. 36. HAND-AXE, No. 42.

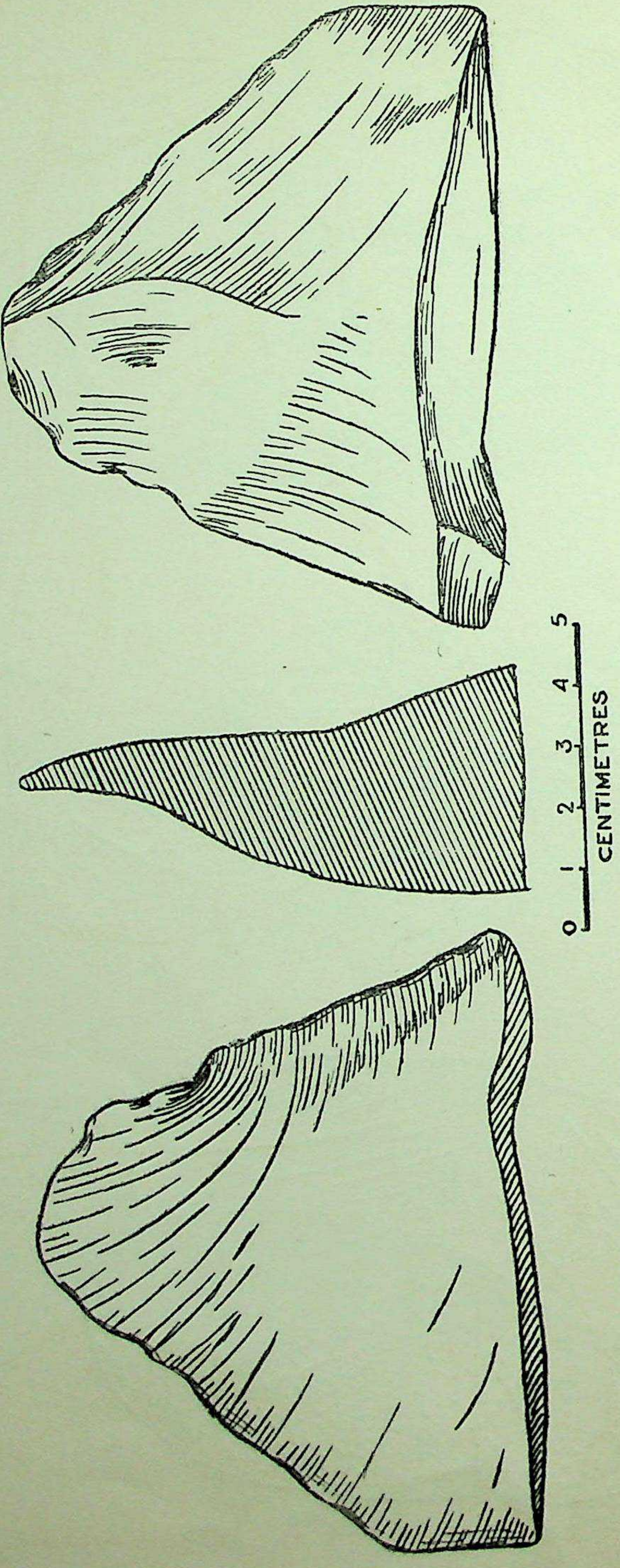
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Fig. 37. Hand-axe ?, No. 17.

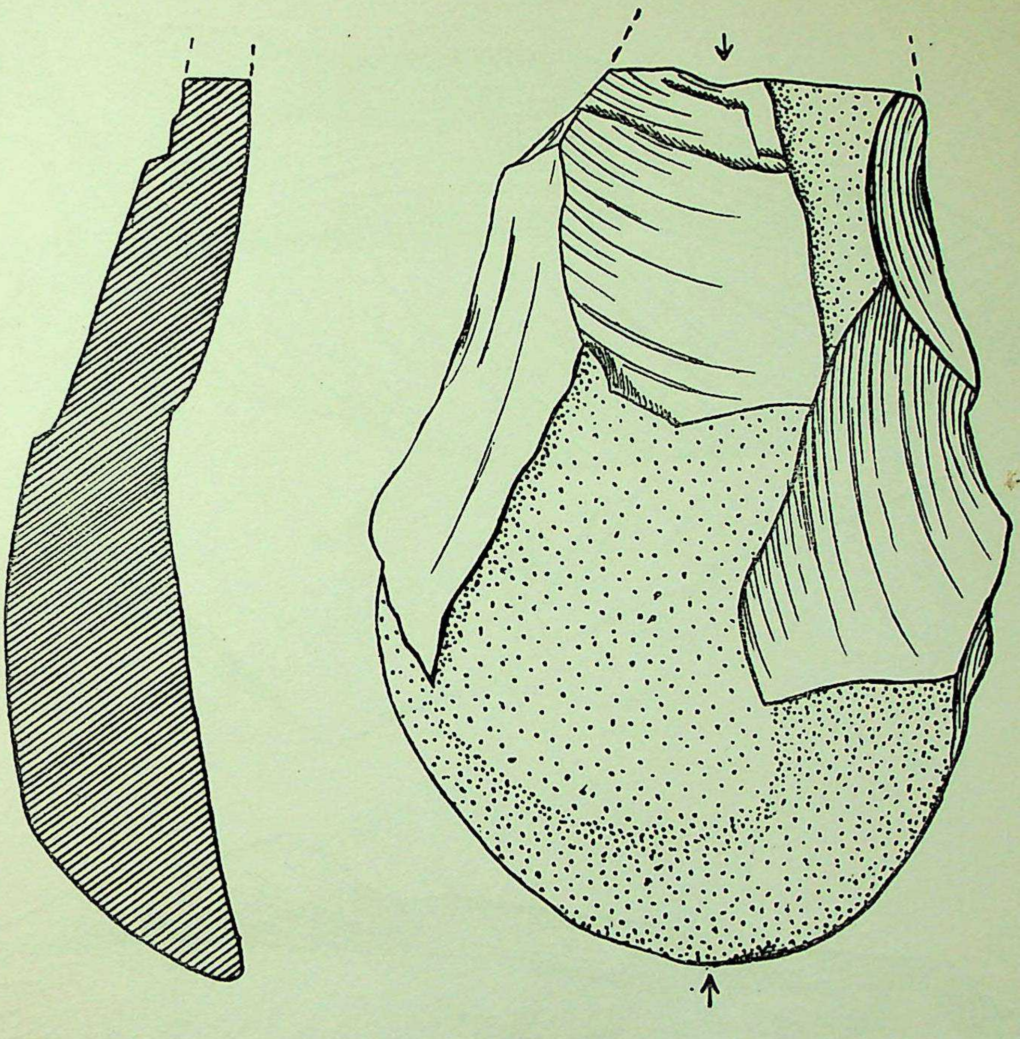
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Fig. 38. Hand-axe ?, No. 32, bottom, Hand-axe ?, No. 3, top.

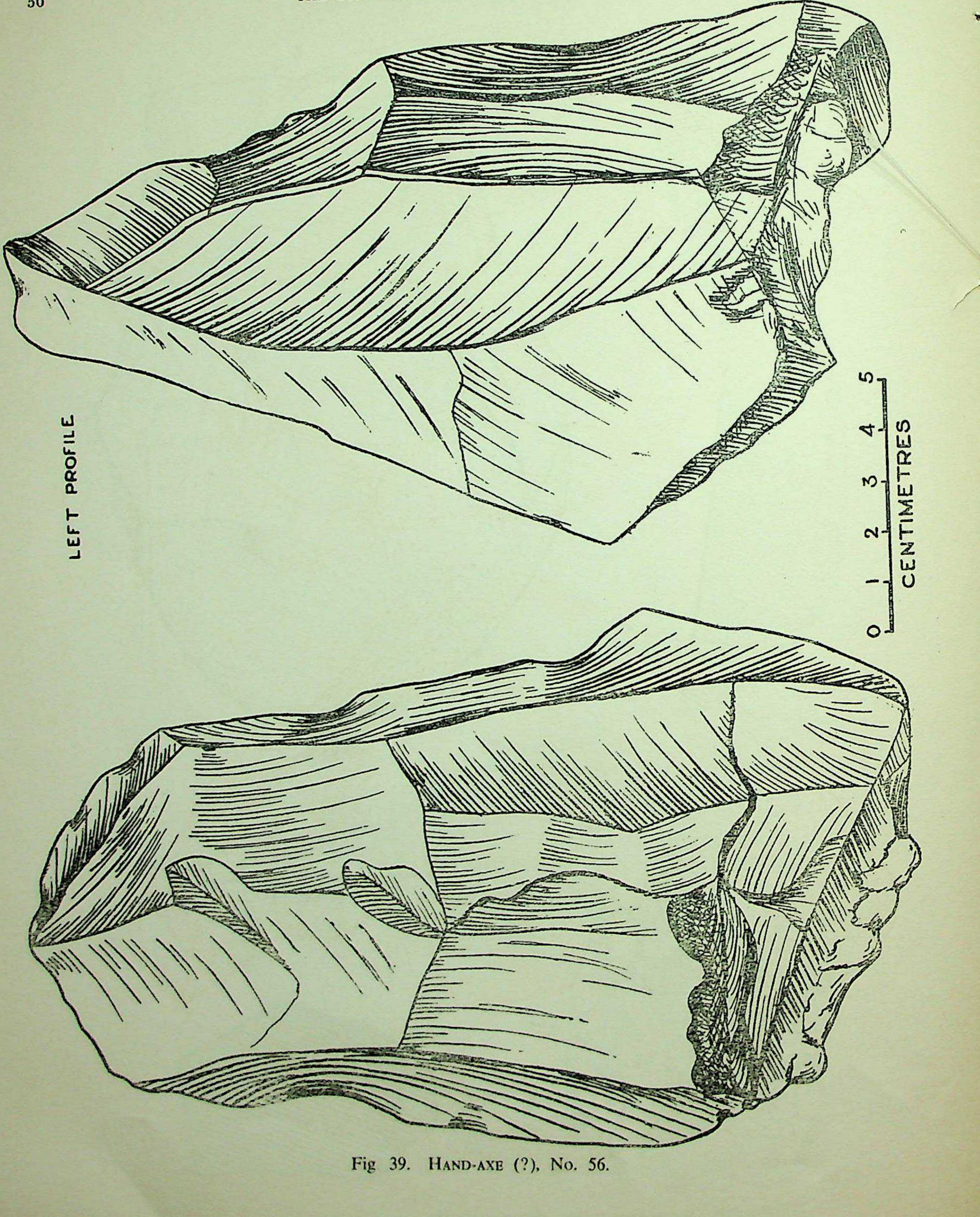
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Fig 39. HAND-AXE (?), No. 56.

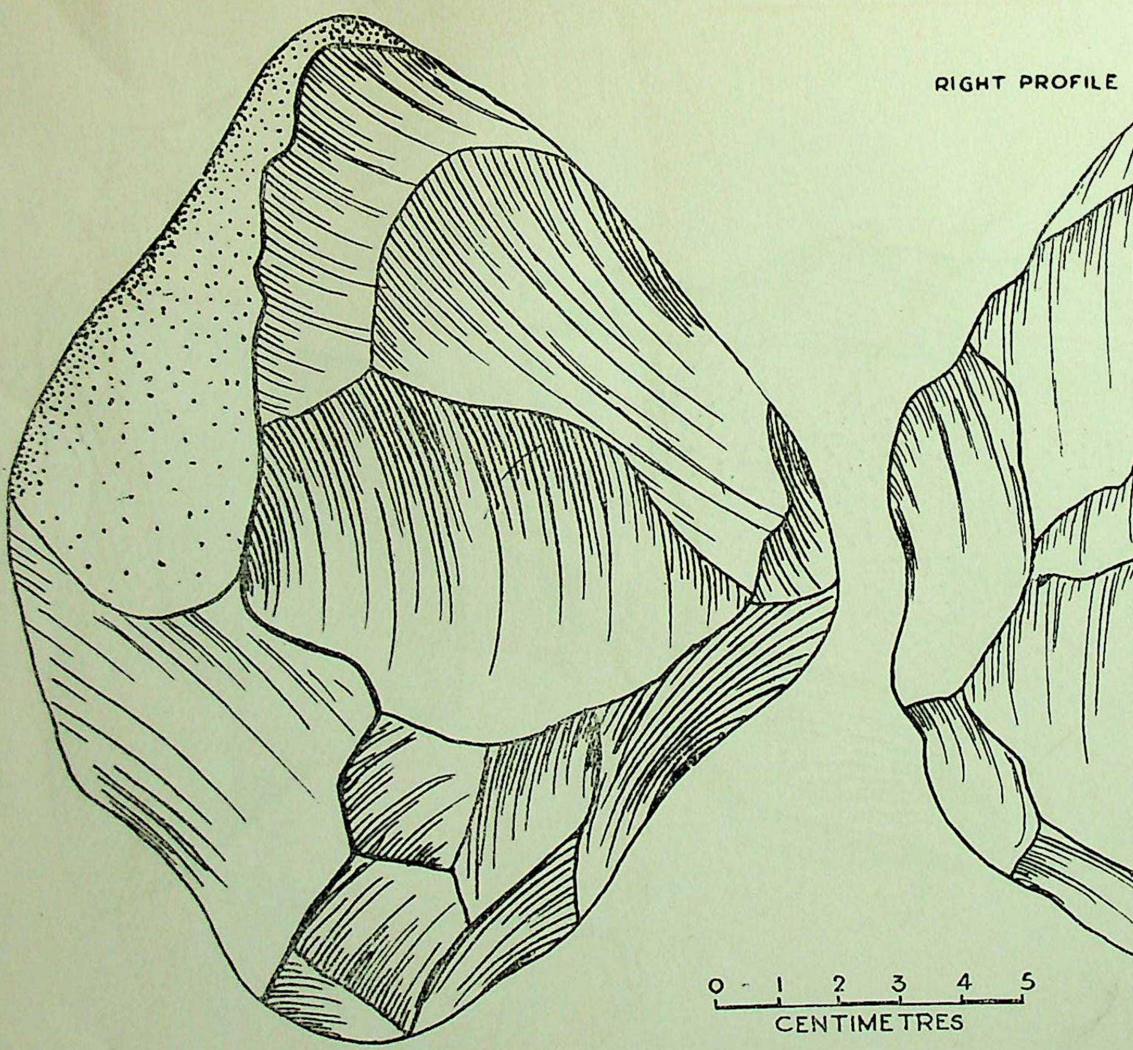
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Fig. 40. Core Chopper, No. 10.

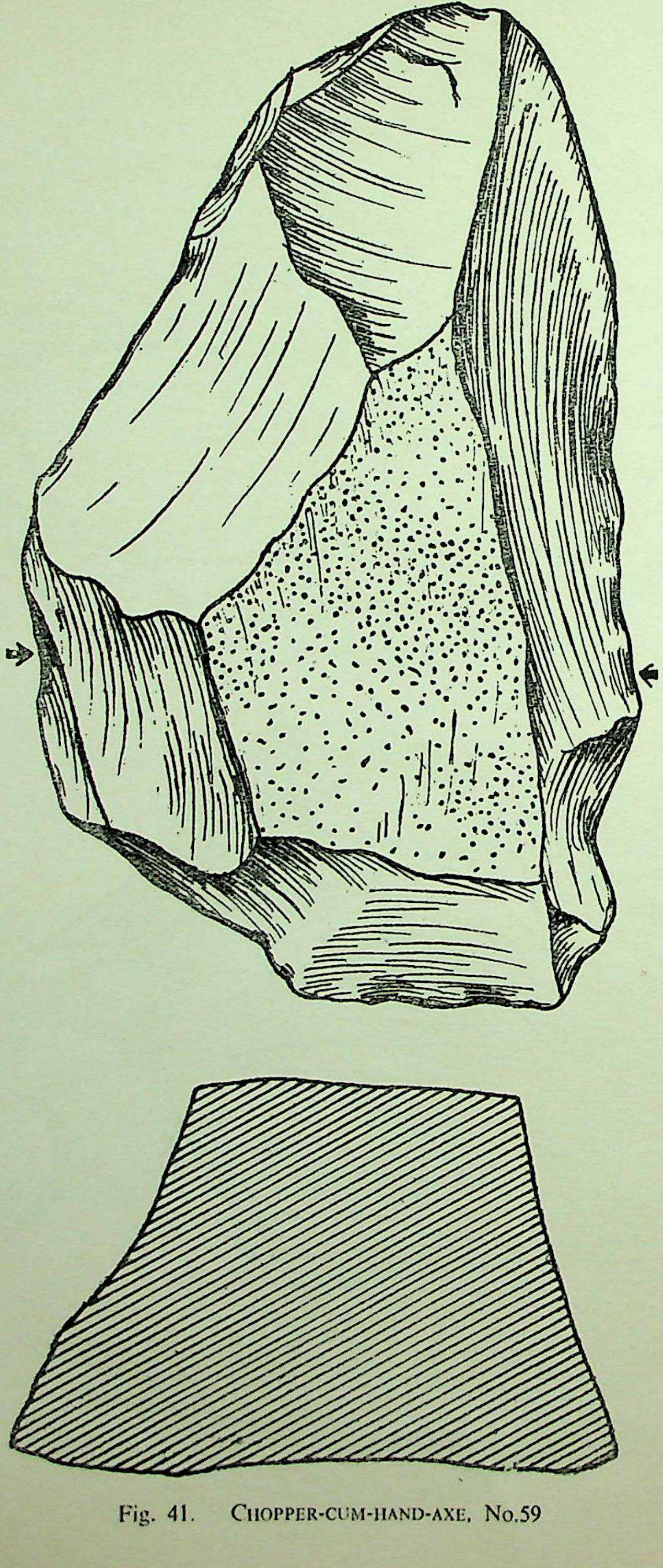

Fig. 41. CHOPPER-CUM-HAND-AXE, No.59

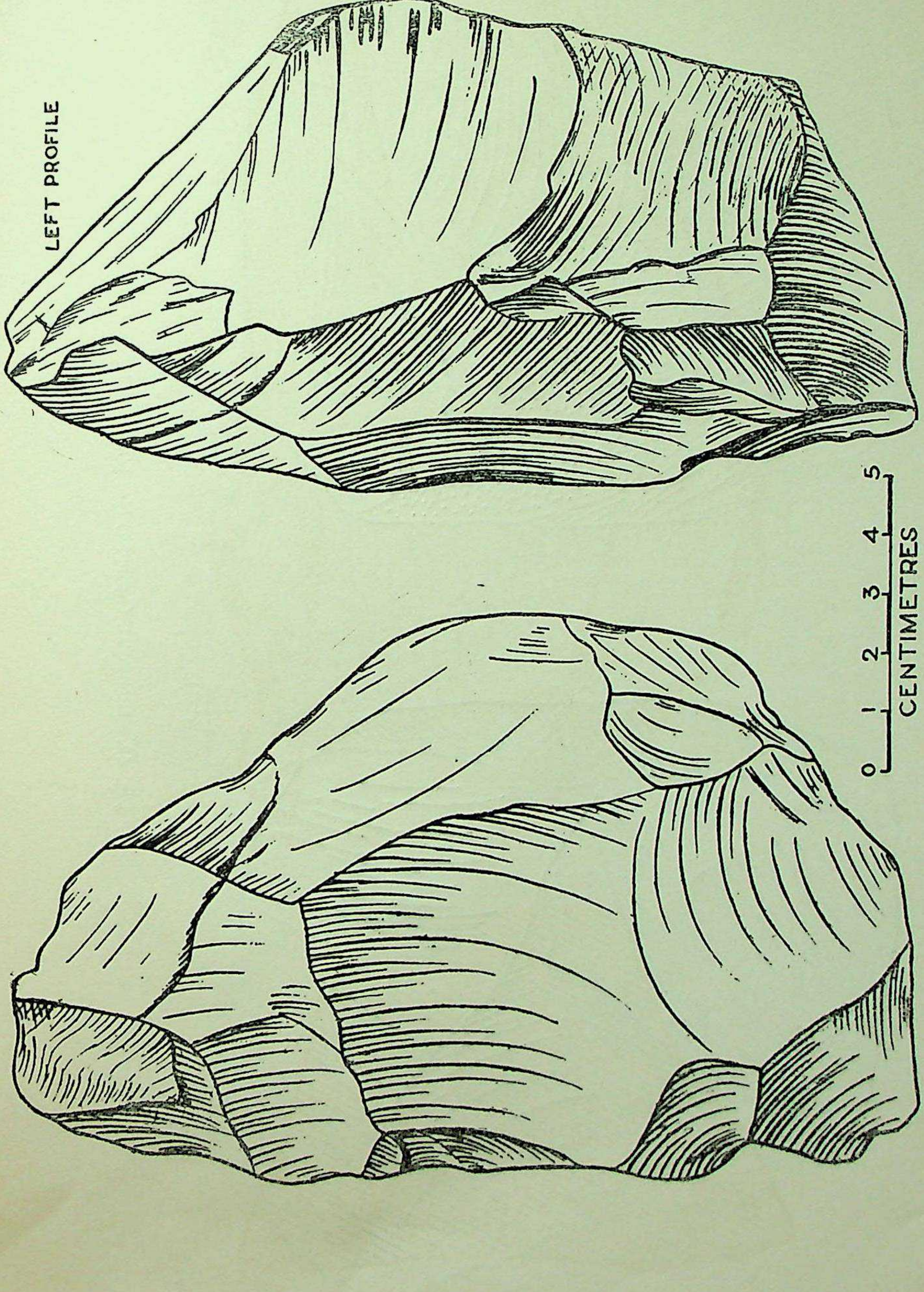
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Fig. 41a. Chopper-cum-hand-axe, No. 59.

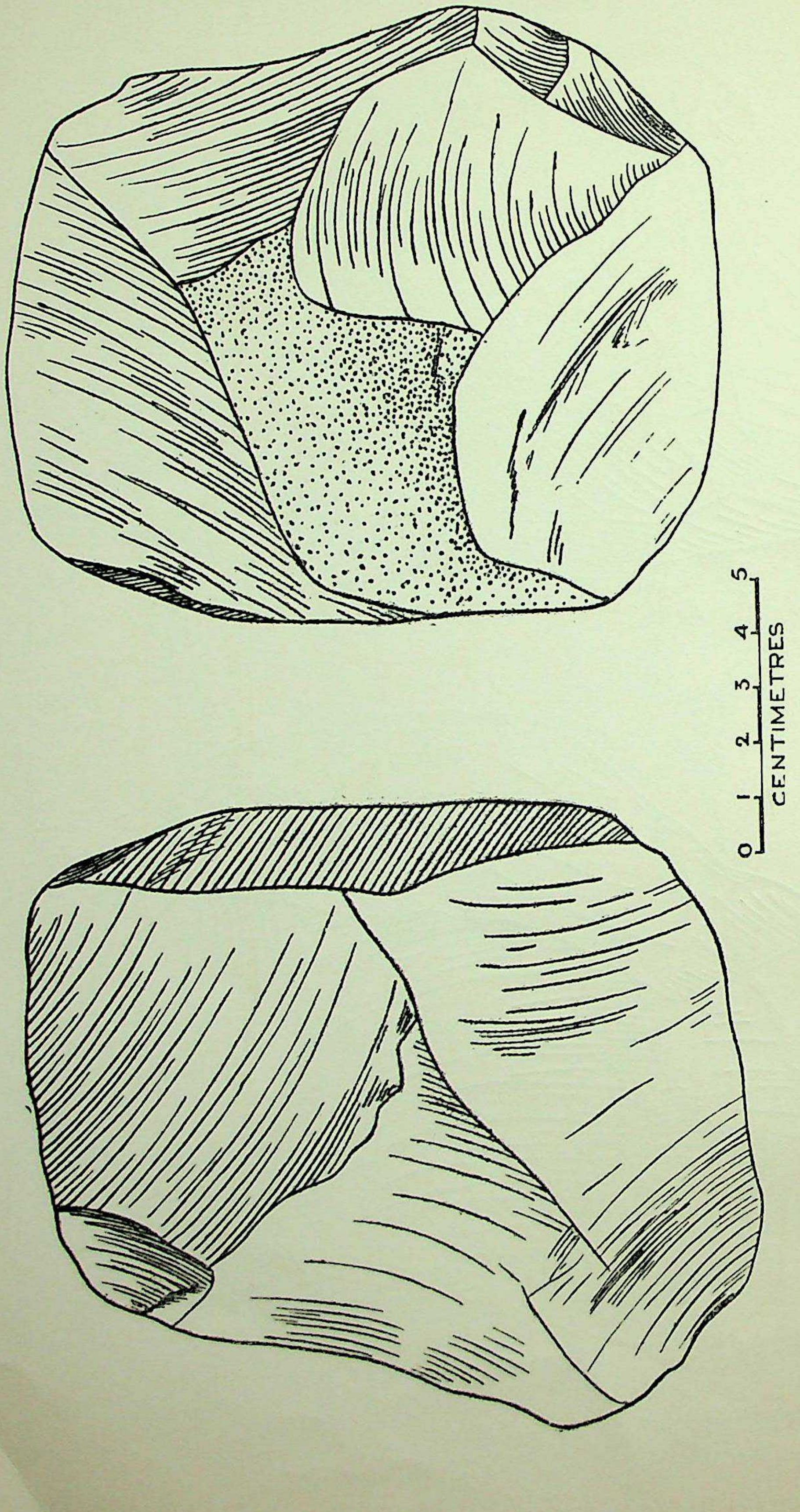
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Fig. 42. Biconical Chopper, No. 60.

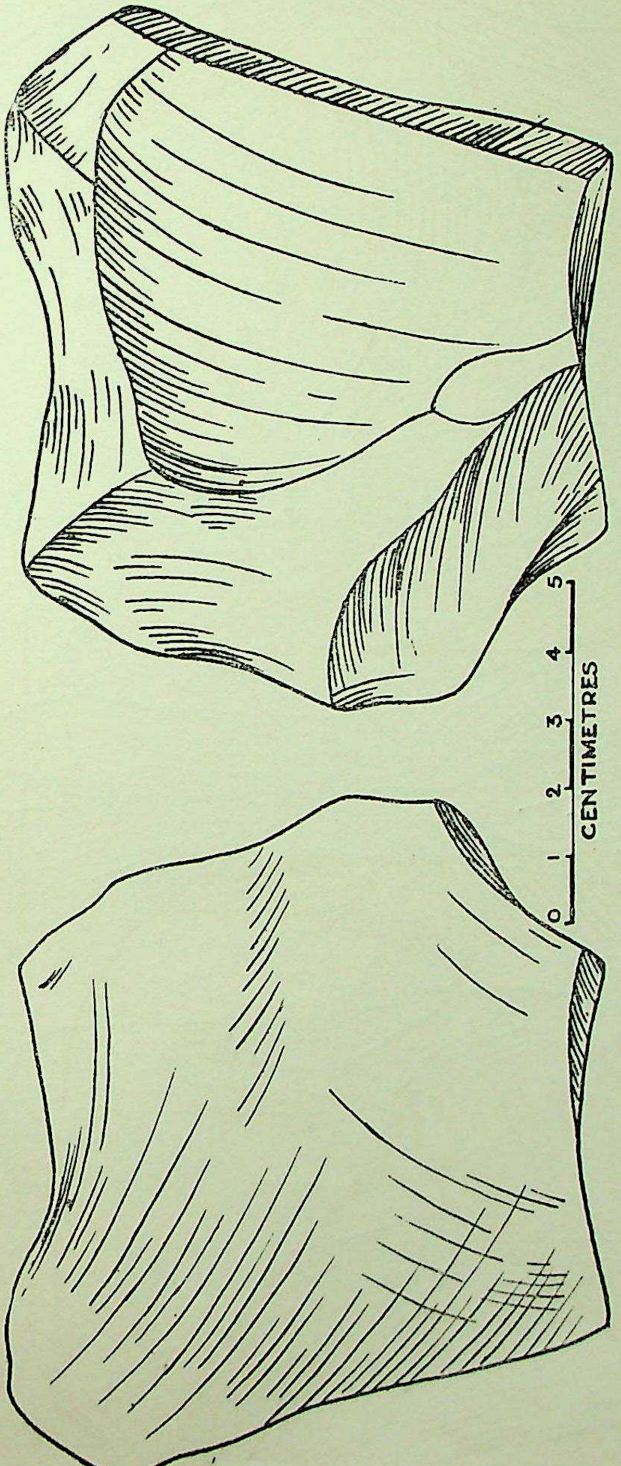
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Fig. 46. Side Scraper, No. 62, (Locality III).

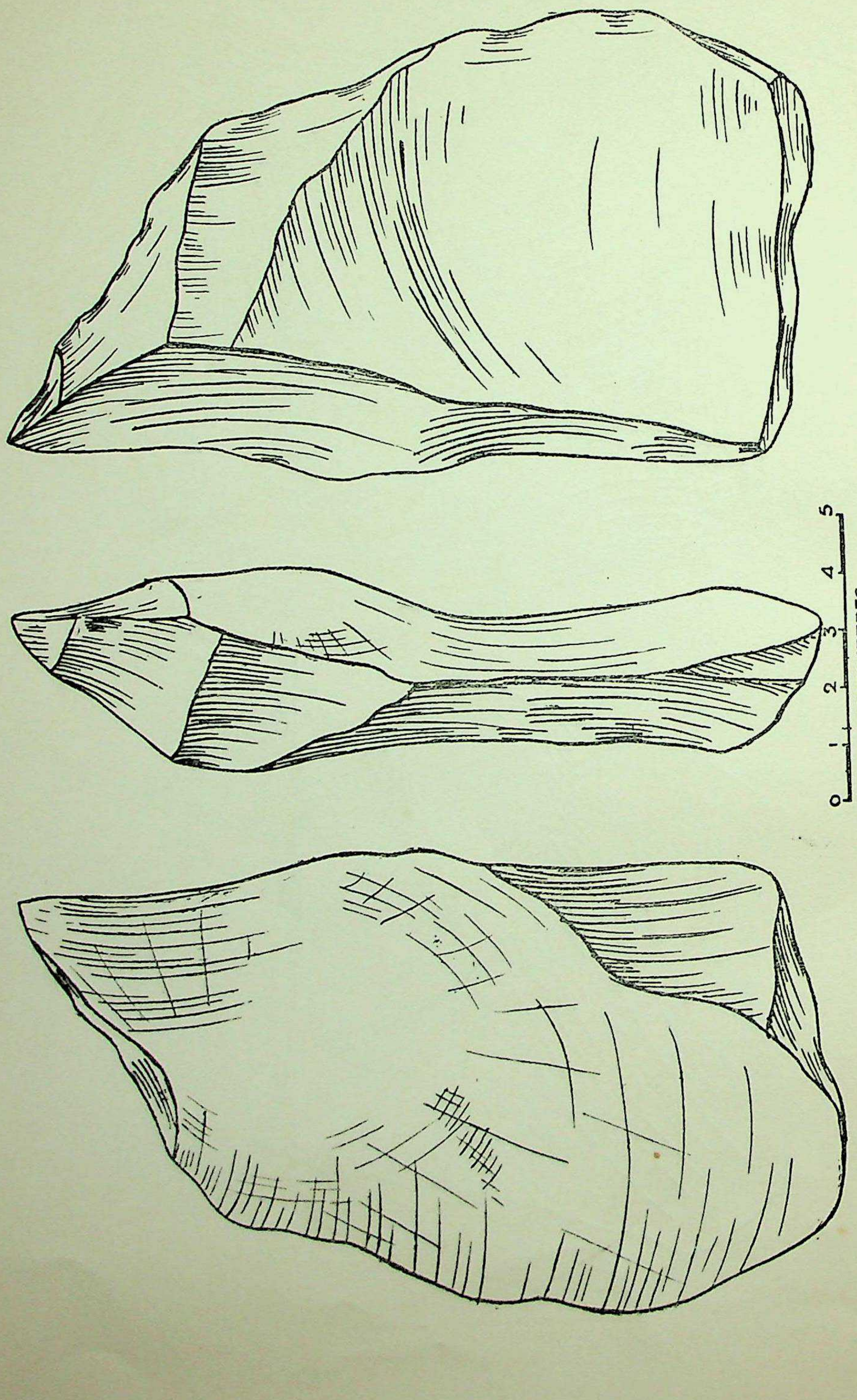
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Fig. 47. Point, No. 64, (Locality III).

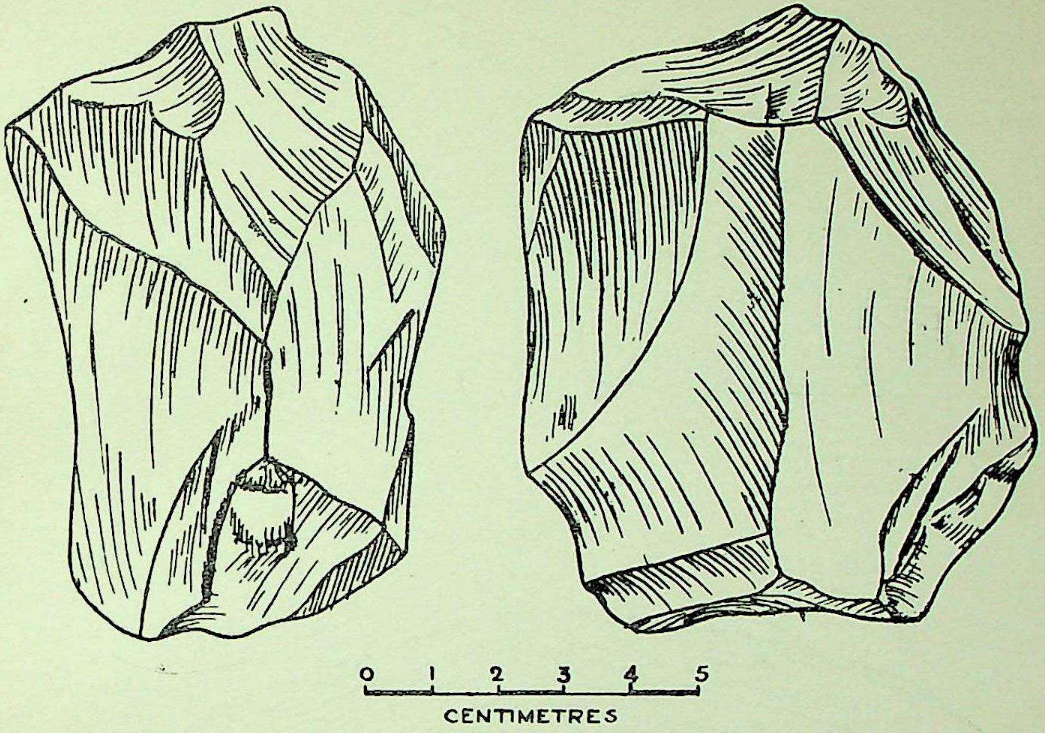
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Fig. 44. Core, No. 61, (From Locality II)

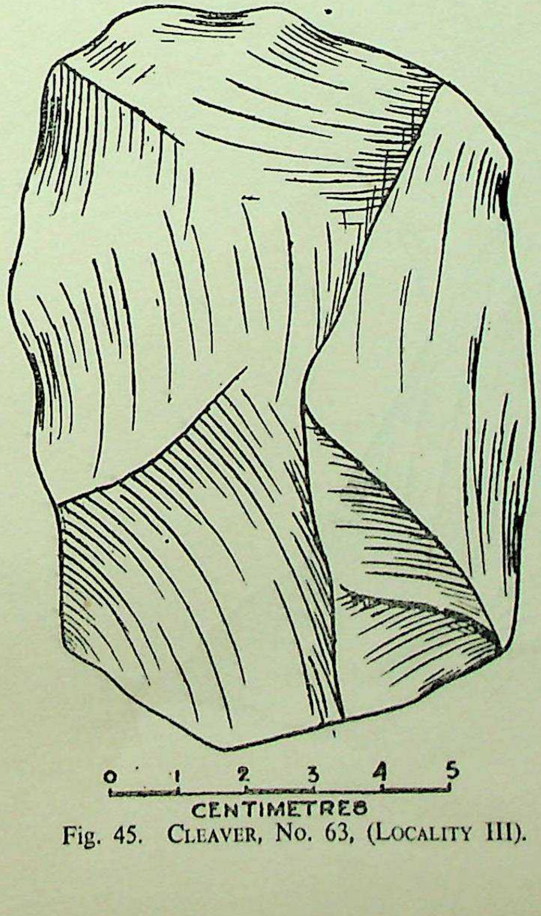
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Fig. 45. Cleaver, No. 63, (Locality III).

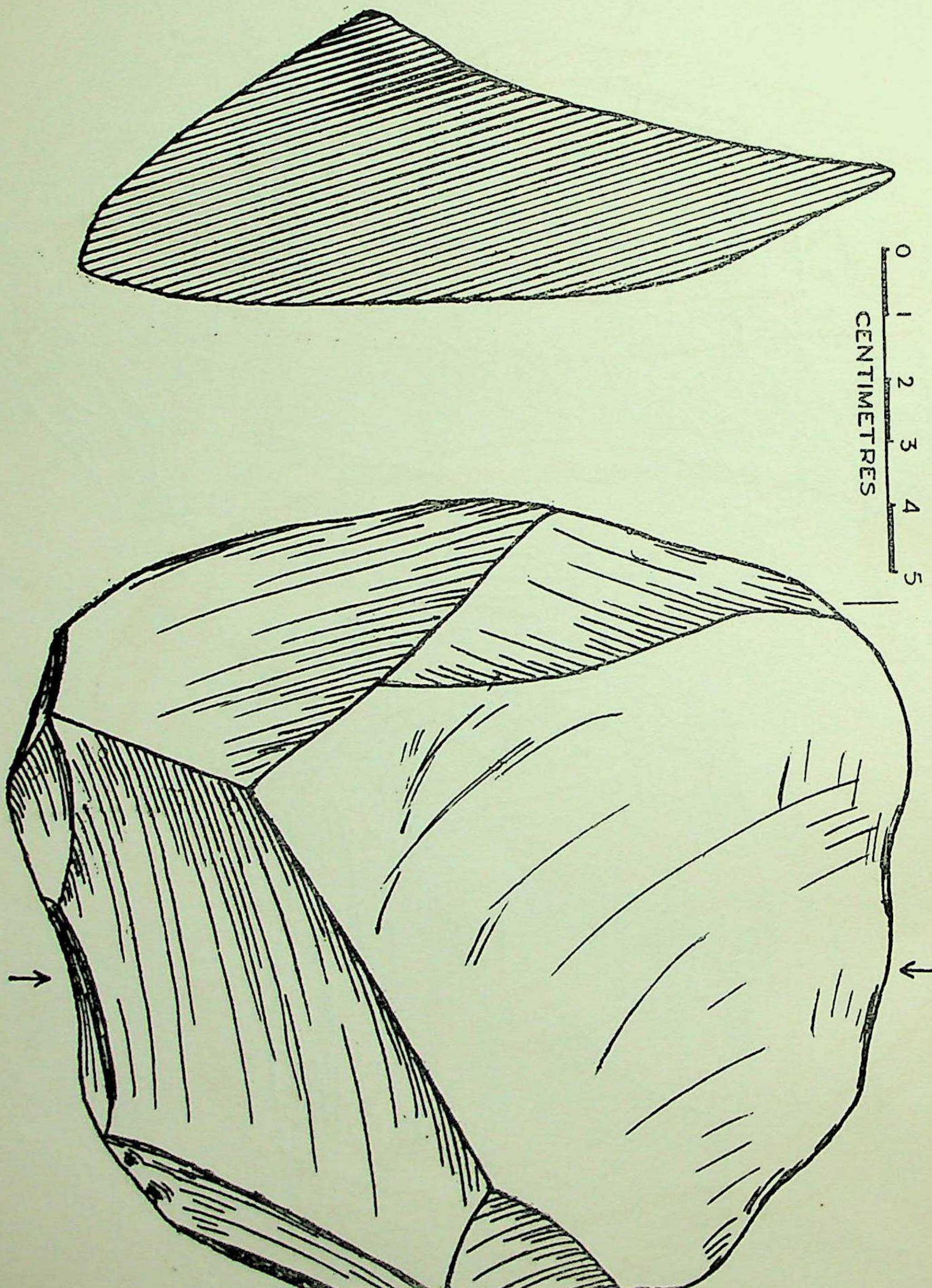
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Fig. 43. Levallois-like Flake, No. 12, (From Fine Gravel, Locality I).

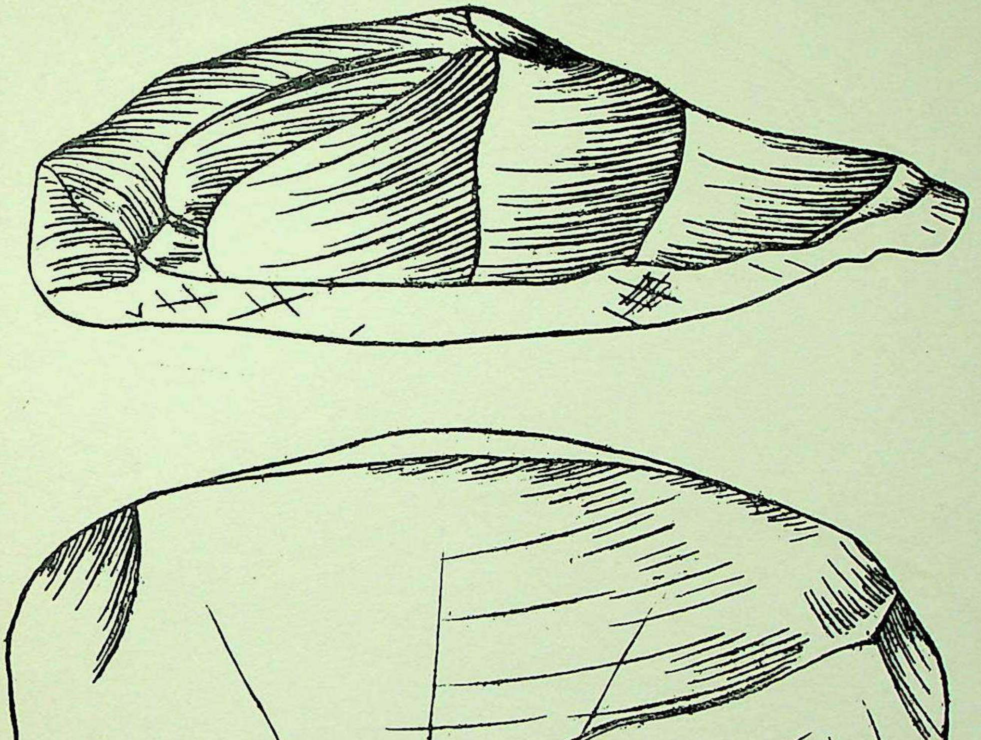

Fig. 43a. Levallois-like Flake, No. 12, (From Fine Gravel, Locality I).

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2. *Words beginning with* अ *in the Udyogaparvan* by E. D. Kulkarni, Demi 4to [**L 10**] (*in press*).

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5. *Kāśakṛtsna-Śabdakalāpa-Dhātupāṭha*, with an old Kannada commentary by Cannavīra, edited by A. Narasimhia. Crown 8vo. pp. xviii + 442. 1952, Rs. 5/-. [**L 21**].

6. *Śāradīyākhyanāmamālā* of Harṣakīrti, critically edited by M. M. Patkar, with glossary. Royal 8vo. pp. x + 102 1951. Rs. 5/-. [**L 23**].

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8. *Nānārtharatna-mālā of Irugapa Daṇḍādhinātha*, critically edited by B. R. Sharma, Royal 8vo. [**L. 26**] (*in press*).

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